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SEISMOLOGICAL OBSERVATIONS AND EARTH PHYSICS.*

By JOHN MILNE, F.R.S., F.G.S.

INTRODUCTION.

THE chief object of the following paper is to point out the character of the information derived from earthquake investigations which throws light upon the physical nature of the interior of our world and the geomorphological changes in operation on or near its surface. The earthquakes to be considered may be divided into two groups—first, those which disturb continental areas and frequently disturb the world as a whole; and secondly, local earthquakes which usually only disturb an area of a few miles' radius, and seldom extend over an area with a radius of 100 or 200 miles.

These former I shall endeavour to show are the result of sudden accelerations in the process of rock-folding accompanied by faulting and molar displacements of considerable magnitude, whilst the latter are for the most part settlements and adjustments along the lines of their primary fractures. The relationship between these two groups of earthquakes is therefore that of parents and children.

The former, which represent a disturbance, not only of the crust of the world, but also of the homogeneous nucleus it covers, will be referred to as macroseismic disturbances, or large earthquakes; and the latter, which appear to be the shiverings within the crust, will be referred to as microseismic disturbances, or small earthquakes. To avoid confusion it must be mentioned that several observers refer to the world-shaking

* Read at the Royal Geographical Society, November 11, 1902. Map, p. 108.

disturbances as microseismic, the reason, no doubt, being that they are usually recorded at such a great distance from their origins that their vibrations have so far died down in amplitude and increased in period that they cannot be felt or be seen in the traces of ordinary seismographs. Hence the largest earthquakes have been called small. It also must not be overlooked that the term "microseismic" has been used to describe disturbances evidenced by minute and long-continued swingings of pendulums and other apparatus, the cause of which is, in many instances at least, attributable to movements in the atmosphere rather than in the earth.

I. Macroseisms, or Large Earthquakes.

Their Discovery and Observations.

It is difficult to say when it was first observed that the violent movements of a large earthquake gradually changed in character as they radiated, until at a certain distance from their origin, although they could not be felt, evidence of their existence still remained. After the great earthquake of Lisbon, in 1755, the motion of the water in lakes and ponds observed in England, Scandinavia, and North America, although the ground itself was not observed to move, was attributed to pulsations in the soil which had radiated from the coast of Portugal.

Another form of evidence pointing in the same direction has from time to time been furnished by astronomers. Prof. George Darwin, in a Report to the British Association, 1882, refers to the observations of M. Magnus Nyrén, which are described in the Publications of the Imperial Academy of St. Petersburg, February 28, 1878.

On May 10, 1877, M. Nyrén observed disturbances in the level on the axis of the transit at Pulkova. The oscillations had a period of 20 seconds, and their amplitudes varied between 1·5″ and 2″. He attributed this to an earthquake which had occurred 1^h 14^m earlier at Iquique, and calculated the rate at which the wave-motion was transmitted *through* the earth. It may be mentioned that the amplitudes and periods here given in all probability refer to the large waves which had travelled *round* the world, the smaller preceding waves which had passed through the same having escaped observation.* M. Nyrén also refers to two other oscillations of level observed at Pulkova to distant earthquakes.

Similar alterations in level had been previously observed by M. Wagner and M. Romberg, but these had not been connected with earthquakes, "at least with certainty."

The first instrumental record obtained by the writer of an earthquake which could not be felt, and which, therefore, must have reached

* At the time of this earthquake the writer was on the east coast of Japan, where twenty-five hours after its occurrence the sea rose and fell from 5 to 10 feet.

his station from a great distance, was on March 25, 1884 (see *Trans. Seis. Soc.*, vol. x. p. 6). These earthquakes were subsequently referred to as "slow earthquakes," the period of motion being so long, or the movement so slow, that they could only be observed instrumentally.

It was the consideration of a long series of observations like those just referred to which in 1883 justified the writer in saying that "it is not unlikely that every large earthquake might with proper appliances be recorded at any point on the land-surface of the globe" (see 'Earthquakes,' p. 226. Internat. Scientific Series).

This statement was not realized until six years later, when the late Dr. E. von Rebeur Paschwitz found in the photographic records of the displacements of a horizontal pendulum, established with the expectation of at least detecting the gravitational influence of the moon, abnormal movements which he traced to earthquakes which had originated at great distances from his observing station. A long list of these, with their analysis, is to be found in vol. ii. of the *Beiträge zur Geophysik*, 1895. In the same volume, Von Rebeur makes many references to the work the writer of this paper was at that time engaged upon in Japan, where, with apparatus similar to that employed in Europe, earth-tremors and earth-pulsations were being recorded. In these records, abnormal movements also occurred which corresponded to those observed in Germany. Although this method of recording unfelt movements of the ground was independently reached in two distant countries, the priority of the discovery belongs to Von Rebeur, a man whose loss is to be regretted by all students of geophysics.

From this time seismologists had before them a new field for research, and stations to record world-disturbing earthquakes are now to be found in very many countries. The most complete organization of stations is that working in co-operation with a committee of the British Association. At each of the thirty-eight places named upon the accompanying map (p. 108) there is an instrument similar to that described in the *Geographical Journal*, March, 1896. Every half-year such registers as have been received from these stations are published as a pamphlet, and copies of the same are forwarded not only to those working with the British Association type of instrument, but to other seismologists who desire to have the same. In this way each observer is in a position to analyse the records to which he has contributed from his own standpoint; and where they include observations relating to earthquakes which originated in or near to his own country, he is frequently, in consequence of local knowledge, enabled to make analyses much more completely than they would be made by persons at a distance. The Association also issues an annual report on the observations. This, then, is the position of macroseismic investigations as carried out from Great Britain. We will next consider the results which arise from this work.

On Earth-waves, their Velocity of Propagation and the Bearing of this on the Physical Nature of the World.

When a large earthquake takes place, it seems to propagate a series of waves all through the world and in all directions over its surface.

The first movements to arrive at a distant station (see Fig. 2) are usually spoken of as preliminary tremors, and the group they constitute as the first phase. Their amplitudes are usually to be measured by fractions of a millimetre, and their periods, which are short, usually vary between 0·1 of a second up to 5 seconds, the longer period waves being found at stations remote from an origin. Their velocity within 1000 kilometres of an origin is from 2 to 2·2 kilometres per second, but beyond this distance the apparent average velocity along a chord is about 9 kilometres per second. They pass through a diameter of the Earth in about twenty-two minutes, which implies an average velocity of about 9·6 kilometres per second. They are regarded as being compressional in character. The approximately constant velocity with which they are propagated suggests a nucleus that is approximately homogeneous.

The second phase of motion consists of waves larger in amplitude and longer in period than those in the first phase. These have been regarded as distortional.

Succeeding these, and forming the principal part of a seismogram, are the largest waves. The average periods of these vary between fifteen and thirty seconds, but periods exceeding sixty seconds have been observed. The nature of these waves is still *sub judice*. Some observers are apparently convinced that they represent horizontal displacements, whilst others, which include myself, incline to the opinion that they have an undulatory character, but the tilting is not so great as, until quite recently, has been generally supposed.

Observations made at Kew, Shide, Bidston, and Edinburgh, where the foundations on which the instruments rest are respectively alluvium, chalk, sandstone, and volcanic rock, indicate that if the movements caused by the same series of earthquakes are regarded as horizontal displacements, then there are considerable differences in their amplitudes recorded at these stations, whilst if we regard these movements as tiltings, the records for at least three of these stations are in close accordance. Assuming that this latter result meets with confirmation, it would appear that the large waves of earthquakes pass beneath a country like Great Britain with the character of an ocean swell, causing forced but equal undulations in the heterogeneous crust above.

Observations which are contrary to this view are as follows:—

1. Clinometers have hitherto failed to detect any tilting effects.

2. If it is assumed that the records of horizontal pendulums give angular values for tilting, and from the period of the waves causing

these tiltings and the velocity with which these waves are propagated we calculate their length, we have on the assumption of simple harmonic motion all the elements which are required to calculate the heights of these waves. Now these heights are frequently as much as 1 or 2 feet, and apparently represent accelerations $\frac{1}{50}$ of gravity. The magnitude of these quantities is certainly sufficient to create a suspicion that the angular values assigned to large waves have hitherto been exaggerated.

3. The slight evidence of vertical displacements afforded by vertical spring seismographs.

4. Dr. F. Ōmori's observation that the amplitude of seismograms is not dependent upon the sensibilities of the seismographs to tilting suggests that the movements represented by large waves are horizontal rather than undulatory.

5. The smallness and paucity of records obtained from bifilar pendulums.

On the contrary, observations which support a surface undulation hypothesis are the following:—

1. Surface undulations exist in epifocal districts, and these, by the movement of water in ponds and lakes, the movements of the bubbles of spirit levels, the apparent movement of stars in the fields of telescopes, and by other phenomena, have been detected in districts many hundreds of miles beyond the epifocal area.

2. The approximately constant velocity of propagation assigned to large waves (see Fig. 1). This implies propagation in a homogeneous layer beneath the crust, the angular movements of which would be equal over considerable areas—a supposition which is supported by observations at three British stations.

3. Observations made by the writer in Japan and in the Isle of Wight, which show that the magnitude of a seismogram is dependent upon its sensibility to tilting, a conclusion apparently contrary to that arrived at by Dr. Ōmori.

4. The indications of a vertical component of motion, which have been recorded. These, however, have been very slight.

When discussing the characters of macroseismic motions it must not be overlooked that these characters are simply those as shown in seismograms which, to a greater or smaller degree, have been influenced by the natural period of the recording instrument. If this instrument has a short period, the preliminary tremors may be represented as having a large amplitude, whilst the so-called large waves become small; that is to say, so far as amplitude is concerned, we arrive at results the opposite to those described. The most certain element respecting these movements is that relating to the speed at which they are propagated, but even this, in these early stages of investigation, is open to modification.

Fig. 1, which shows the time taken for three types of wave-motion to

travel from an origin to stations at different distances measured in degrees, enables arcual or other apparent average velocities to be calculated.

Inasmuch as velocity through our earth depends directly on the square root of the coefficient of elasticity and inversely with the square

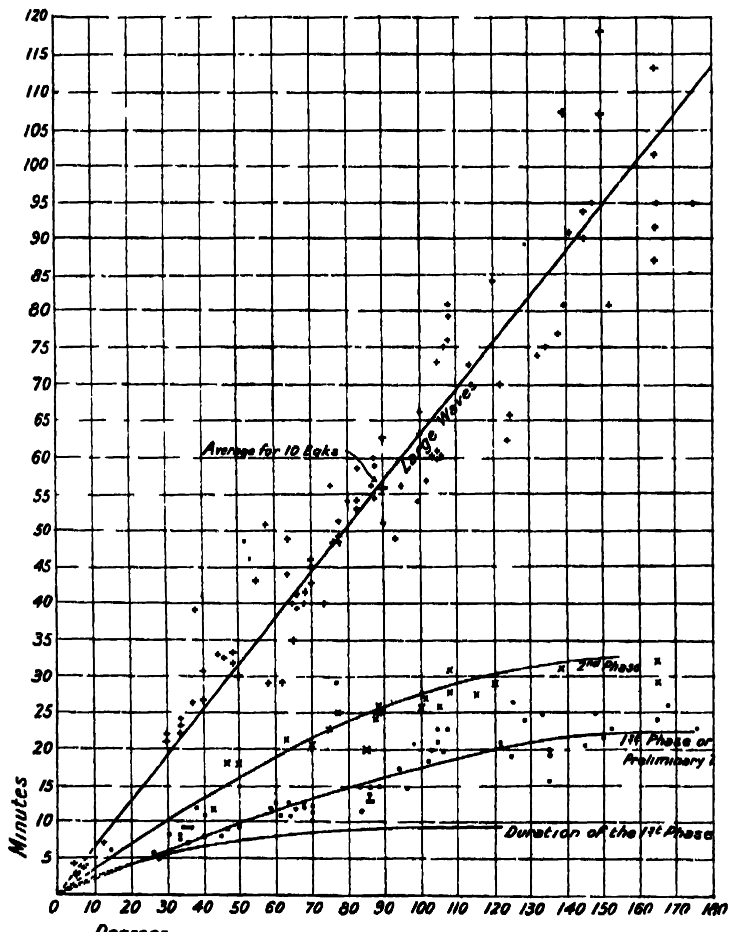


FIG. 1.—TIME CURVES FOR EARTHQUAKES RECORDED BETWEEN 1896 AND 1900 INCLUSIVE.

First phase or preliminary tremors · Second phase × Large waves +

root of its density, if we can make some assumption as to the distribution of density within our earth we are on the highway to make approximate determinations respecting its elasticity. Dr. C. G. Knott, of Edinburgh, has already occupied himself with this line of investigation (*Scottish Geographical Magazine*, January, 1899), and which, it is to

be hoped, now that better observational data are at hand, he will be induced to continue. As matters now stand, it appears that the effective rigidity of the world is nearly twice that of steel. It has a heterogeneous crust, and a nucleus more nearly homogeneous than is usually supposed.

Origins of World-shaking Earthquakes.

From Fig. 1 it will be observed that it is easy to measure the difference in time between the arrival of preliminary tremors and large waves at different distances from their origin. For example, preliminary tremors reach a place 80° from their origin in about 15 minutes, whilst large waves take about 50 minutes, the difference being 35 minutes. If, therefore, a seismogram shows such an interval, it means that it refers to an earthquake which originated somewhere about 80° distant. Having in this manner obtained the distances of an origin from several different stations, this origin may be easily located.

Another method of locating origins is from the difference in time at which the large waves arrived at widely separated stations. By these and other forms of calculations the origins of the world-shaking earthquakes for 1899, 1900 and 1901 have been determined. On the accompanying map an attempt has been made to place these earthquakes in groups, each group being enclosed by a dotted line. These groups are marked alphabetically and with numerals, the latter indicating the number of large earthquakes which took place in the district to which it refers. The pink bands give the direction of prominent ridges on the face of the globe, whilst the areas coloured blue are the "deeps" or depressions in the beds of various oceans exceeding 3000 fathoms in depth.

That there is a relationship between the distribution of the origins of large earthquakes and the pronounced irregularities on the surface of the earth will be seen from the following notes:—

A. *Alaskan Region* (number of earthquakes 25).—The average depth of the water in this bight is about 2000 fathoms, but in its northern part depths of 2200 fathoms have been found within sixty miles of the shore. On this shore Mount St. Elias rises to a height of 18,000 feet. An average slope from the land to the sea on a north-south line can be found which exceeds 100 feet per mile. This is over a distance of 180 miles.

On the face of this and neighbouring slopes during the last three years it is probable that molar displacements of great magnitude have taken place. On September 10, 1899, in the island of Kanak, opposite Yakuta, a graveyard sank so that on the next day a boat was able to row over the place where it had been, and the tops of the submerged trees could be seen. Many of the earthquakes from this region have yielded large seismograms at the Cape of Good Hope, which is antipodean to Alaska. We have here a district partly belonging to the

Alutian ridge, off the southern shores of which, within 80 miles of land, depths of 4000 fathoms have been noted, where orogenic processes are now marked, the extent of which will probably be gauged by future soundings.

B. *Cordilleran Region* (number of earthquakes 14).—This region forms the western side of the Mexican plateau and the Cordilleras. Just south of the 20° parallel a depth of 2800 fathoms has been found within 40 miles of the shore, whilst depths exceeding 2000 fathoms have been found a little over 100 miles from the land, somewhat farther to the south. Although there are peaks in these regions rising to heights close upon 18,000 feet, the average height of the ranges does not greatly exceed 6000. There are, therefore, in this region slopes of 180 to 570 feet per mile, and the instability of these is testified by the frequency of their yieldings.

C. *Antillean Region* (number of earthquakes 16).—Here we have at least two ridges to consider—that of Cuba, Haiti, and Puerto Rico running east and west, and that of Grenada, St. Vincent, Martinique, Dominica, and other islands running north and south. The east-west ridge slopes steeply to the north into water which, north of Puerto Rico, attains a depth of 4500 fathoms, and to the south into water 2500 fathoms in depth. These depths are respectively found at distances of 60 and 40 miles off land, and indicate slopes of 400 and 375 feet per mile. With the north-south ridge the slopes to the west over a short distance like 12 miles is 1000 feet per mile, whilst to the eastwards it is comparatively gentle. If these gradients be measured in lengths of 200 miles, the slopes are about 70 feet per mile.

D. *Andean District* (number of earthquakes 12).—At many points on the west coast of South America, within 50 miles of the shore, depths of from 2000 to 4000 fathoms occur, which correspond to gradients of from 250 to 480 feet per mile. Within a distance of 150 miles from the shore the land rises to a height of 12,000 feet, so that the gradients from them to the bottom of the neighbouring ocean may be taken at 120 to 180 feet per mile.

E. *Japan District* (number of earthquakes 29).—To the east of Northern Japan and the Kuriles, at a distance of about 180 miles off shore, depths of 4000 and even 4600 fathoms are found, indicating gradients of 130 to 150 feet per mile, and from observations made in Japan it is known that many of the large earthquakes originate on the face or at the bottom of these slopes.

F. *Javan District* (number of earthquakes 41).—Off the south-west coast of Sumatra and the south coast of Java, at distances of from 80 to 100 miles, depths of from 2000 to 3000 fathoms occur. The straits on the opposite shores of these islands are shallow, seldom exceeding 30 fathoms. Eastwards, from Java as far as Ceram, soundings between 1000 and 2000 fathoms are frequent. At one point 50 miles south of

the latter island there is a depth of 4000 fathoms. From this particular "deep" on September 29, 1899, a displacement took place the effects of which were partially visible by subsidences on the southern coast of Ceram. In this district the sub-oceanic irregularities are as irregularly distributed as the islands between which they occur.

G. *Mauritian District* (number of earthquakes 17).—The origins for this group of earthquakes are not well defined. They are probably related to the depression lying between the ridges represented by the Laccadives and Maldives on the east, and the Seychelles and Mascarine islands to the south-west.

H. *North-Eastern Atlantic* (number of earthquakes 22).

I. *North-Western Atlantic* (number of earthquakes 3).

J. *North Atlantic* (number of earthquakes 3).

The earthquakes originating in these districts have been few in number, comparatively small, and their origins are not well defined. Although a ridge is marked as extending up the Atlantic, it is comparatively small, and even in the vicinity of the Azores it is difficult to find a gradient over a distance of 180 miles which exceeds 33 feet per mile.

K. *Alpine, Balkan, Caucasian, Himalayan Districts* (number of earthquakes 14).—Strictly speaking this region, which is the only one from which earthquakes originate on a land surface, might be divided into four or more sub-regions according to the direction of the strike of the ridges which each represent.

The most pronounced foldings are in the eastern part of these districts, where, in distances of 100 miles, gradients of 120 feet per mile can be found; and it is from these steep slopes that the larger earthquakes have originated.

On the Magnitude of the Mass Displacements which accompany Large Earthquakes.

When a world-shaking earthquake takes place, and its origin is sub-oceanic, we occasionally get evidence that this has been accompanied by the bodily displacement of very large masses of material. For example, sea-waves may be created which will cause an ocean like the Pacific to pulsate for many hours. The dimension of the mass which was moved, and inasmuch as the displacement was beneath the surface of the ocean, must have been moved suddenly, to create an effect of this description, is not known. The observations made by cable engineers, which have shown that in the vicinity of the origin of such earthquakes depths have been greatly increased, and this over a considerable area, enable us to make rough approximations respecting these dimensions. When the effect has extended to shore-lines, we are enabled to measure definite amounts of elevation or depression.

With large earthquakes which have originated on land surfaces, the

accompanying displacements are visible, and their magnitudes are, to a certain extent, measurable.

The following notes, the first ten of which are taken from vol. ii. of Lyell's 'Principles of Geology,' 12th edition, will assist us in realizing the magnitude of the mass displacements which occur each time the world is shaken:—

1692. *Jamaica. The shore-line at Port Royal subsided* 26 *to* 48 *feet beneath the sea.* 1000 *acres sank.*

1755. *Lisbon. The quay sank.*

1762. 60 *miles of Chittagong coast sank.*

1783. *Calabria. The relative shifts along lines of rents were from* 6 *to* $10\frac{1}{2}$ *feet. The quay at Messina sank* 14 *inches below sea-level.*

1790. *Caracas. Soil sank to form a lake* 800 *yards in diameter, and in places* 100 *feet in depth.*

1811-12. *West of New Madrid. The "sunk country,"* 70 *to* 80 *miles in length by* 30 *miles in breadth, was formed.*

1819. *Cutch.* 2000 *square miles of land were converted into an inland sea. At the same time land* 50 *miles long and* 16 *miles broad was raised about* 10 *feet.*

1822. *Chili. The shock extended* 1200 *miles. The coast was raised* 3 *to* 4 *feet, whilst a mile inland the rise was* 5 *to* 6 *feet. Possibly* 100,000 *square miles were permanently elevated, and if this was lifted* 3 *feet it means that* 57 *cubic miles of material had been suddenly shifted.*

1835. *Chili. An earthquake was felt along* 1000 *miles of coast, which was in places raised from* 2 *to* 10 *feet.*

1855. *New Zealand.* 4600 *square miles were raised* 1 *to* 9 *feet.*

1868. *Chili. Sea-waves reached Japan, where they rose and fell for five hours.*

1877. *Chili. Waves like those of* 1868 *disturbed the Pacific Ocean.*

1891. *Japan. River-beds were compressed about* 2% *of their width. A fault of* 40 *or more miles with a downthrow in places of* 20 *feet was formed.*

1892. *Sumatra. The length of base lines were changed* 5 *feet, and angles were altered.*

1897. *Assam. According to R. D. Oldham,* 10,000 *square miles of country were displaced, possibly* 16 *feet along a thrust-plane. A revisionary triangulation showed changes of* 4 *to* 24 *feet in the length of base lines, and in heights of* 2 *to* 14 *feet.*

1899, *Sept.* 10. *Alaska. A graveyard on the island of Kanak sank beneath the sea.*

1899. *Ceram. Subsidences along the southern coast.*

Earthquakes, accompanied by submarine displacements, along lines 10 and more miles in length and increased depths, such as have been recorded by cable engineers, also indicate molar displacements of great size. As examples of such changes the following may be quoted (see Suboceanic Changes, *Geographical Journal*, Aug. and Sept. 1897):—

1884, *Oct.* 1. *Three Atlantic cables* 10 *miles apart broke at apparently the same time at points opposite to each other.*

1893, *Sept.* 21. *Two cables between Pernambuco and Cape Verde broke simultaneously in a depth of* 1675 *fathoms.*

Between June, 1895, *and March,* 1896, *carefully made soundings off the mouth of the river Esmeralda* (*W. coast of South America*) *changed* 13 *to upwards of* 200 *fathoms.*

1896. *After the Filiatra shock depths increased* 200 *fathoms. Mr. W. G. Forster, in the Trans. Seis. Soc., vol. xv., gives many illustrations of such sub-oceanic subsidences.*

The cables connecting Java and Australia at places where they are 7 *miles apart have on several occasions been broken simultaneously.*

Large Earthquakes and Geomorphology.

If it can be admitted that world-shaking earthquakes involve molar displacements equal in magnitude to those referred to in the preceding list—which includes some which have been recorded as world-shaking—then, in the map showing the origins of these macroseismic efforts, we see the districts where hypogenic activities are producing geomorphological changes by leaps and bounds

The sites of these changes are for the most part sub-oceanic troughs. When they occur, the rule appears to be that a sea becomes deeper, whilst a coast-line relatively to sea-level may be raised or lowered. For nearly all the regions of the world where they take place we have geological and not unfrequently historical evidence that the more recent bradyseismic movements have been those of elevation. This elevation, however, only refers to the rising of land above sea-level, while the mass displacements seem to be accompanied by sudden subsidences in troughs parallel to the ridges where rising has been observed. In short, at the time of a large earthquake, two phenomena are simultaneously in progress. A sub-oceanic trough may suddenly subside, whilst its bounding ridge may be suddenly increased in height, and the concertina-like closing of the trough may account for the sea-waves. If this be true for accelerations in secular movement, it seems likely that it may be true for changes relatively to sea-level which are performed slowly. In 1811 the sunk country of the Mississippi was formed suddenly, but since that time it appears that the synclinal then initiated has been slowly increasing in its depth.

Although there are movements of elevation and depression in progress in the crust of the earth, these should only be regarded as components of larger horizontal displacements which result in the accentuation in rock-foldings.

Large Earthquakes and Volcanic Activity.

Nearly all active volcanoes occur along the ridges of rock-folds

which are in proximity to oceanic waters. By the percolation of this water to the foundations of these folds, where it comes in contact with a heated magma, extraordinary pressures are developed, the sudden relief of which results in a volcanic outburst. If we accept a theory of this description it is easy to imagine a stage when volcanic strain due to an increasing internal pressure is in a critical condition, and therefore likely to be destroyed by any movement in the rock-fold where it exists.

A good illustration of this relationship between sudden movements in rock-folds and displays of volcanic activity is to be found in the history of the volcanic eruptions in the West Indies and the large earthquakes which have occurred in West Indies or in adjacent countries.

The conditions to be considered are those of the Caribbean sea and its bounding ridges, the magnitudes of which have been referred to on p. 8. The slopes of these ridges, per 30 geographical miles, are as follows :—

Antillean ridge	westwards, 1 in 17; eastwards, 1 in 38.
Jamaica—P. Rico ridge ...	northwards, 1 in 10; southwards, 1 in 20
Cordillerian ridge ...	westwards, 1 in 15 to 1 in 33; eastwards, 1 in 15 to 1 in 38.
South American ridge ..	northwards, 1 in 30 to 1 in 150

The average slopes (for 120 miles) in non-seismic regions vary between 1 in 90 and 1 in 243 (see 'Seismology,' p. 31), whilst those in seismic regions vary between 1 in 20 and 1 in 30. For the Himalayan-like boundaries of the Caribbean sea we therefore see that the geotectonic conditions are such that seismic disturbances might be expected.

From the recent geological history of the region we learn that the Antilles once connected North and South America, whilst the Isthmus of Panama was submerged, the present Caribbean sea being therefore a gulf of the Pacific. In Lower or Middle Miocene times, according to Dr. J. W. Gregory, Antillia itself was submerged, and abyssal oozes were deposited, which are now elevated in the Barbadoes to a height of 1095 feet above sea-level. In fact, the elevations and depressions of this region have been so great and performed with such rapidity that they have frequently been referred to by the opponents to the theory of the permanence of oceanic basins and continental masses. The most recent movements in the Antilles, as indicated by raised sea-beaches, etc., has been upward.

The inference to be drawn from the geological history of this region is that the Antillean ridge is one of unusual instability, and it is likely that in consequence of this characteristic it is so responsive, as will be shown to be the case, to adjustments in neighbouring folds.

The volcanic eruptions which have been recorded in the West Indies are, according to Fuchs ('Vulcane und Erdbeben'), eleven in number, and took place in the following years—1692, 1718, 1766, 1797, 1802, 1812 (two), 1836, 1851, 1902 (two).

The seismic convulsions which apparently resulted in these reliefs of volcanic strain were as follows:—

1692, *June* 7. *Port Royal in Jamaica destroyed, and houses thrown down throughout the island. St. Kitt's erupted.*

1718, *March* 6 *to* 7. *At St. Vincent's there was a very violent earthquake. Land rose from the sea, and then sank. Morne Garou (La Soufrière) erupted.*

1766, *March* 9. *Violent shock in Antigua. March* 17, *violent shock in Grenada. In Jamaica and Cuba seven shocks between June* 11 *and August* 1. *From the middle of July to the* 21*st violent shocks at Ste Marie, South America. August* 13, *Martinique shaken. August* 18, *Guadeloupe shaken. At the end of the month the city of St. Jago in Cuba was overturned. October* 6, *the island of St. Eustache was shaken. For fourteen months up to the end of* 1767 *Caracas was being shaken, at first almost hourly. October* 21, *Cumana was ruined. For two years the inhabitants of certain towns in New Grenada lived in the streets. An island in the Orinoco sank; Trinidad and Martinique were shaken. Qualibou, in St. Lucia, erupted.*

1797. *February* 4. *Destructive earthquake in Quito, and* 40,000 *persons lost their lives. A series of small shocks lasting eight months took place in the Lesser Antilles. These were "put an end to" by an eruption in Guadeloupe on September* 27.

1802, *February* 2. *"Severe shock" in Antigua. In February and March shocks in the West Indian Islands. In Guadeloupe there were shocks, and in February an eruption.*

1812. *On March* 26 *Caracas was destroyed, and* 10,000 *people lost their lives. Shocks continued until April* 5. *The waters of Lake Maracaybo lowered, and Mount Silla is said to have subsided* 360 *to* 300 *feet. In St. Vincent more than* 200 *shocks were felt, and on April* 24 *La Soufrière erupted, and its ashes fell in Barbados.*

On November 11, 1811, *a tremendous earth disturbance commenced in the valley of the Mississipi, Ohio, and Kansas, resulting in the formation of the sunk country. The shocks continued almost hourly until the date of the destruction of Caracas. Guadeloupe also erupted in* 1812.

1835. *On February* 20*th an earthquake was felt for* 1000 *miles along the coast of Chili. Towns were destroyed, and the coast was raised from* 1 *to* 10 *feet. A submarine volcano broke out off Bacalao head, and the volcanoes in the Andes were in an unusual state of activity. In November Concepcion was severely shaken, and on the same day the volcano Osorno,* 400 *miles distant, renewed its activity. Lyell points to these events as illustrating the vast extent of the subterranean areas over which a disturbing cause acts simultaneously.*

In 1831, *on June* 22 (*or May* 22, 23), *different places in Central America*

were shaken, and a volcano east of Omoa erupted. There was also an eruption in Guadeloupe.

1851, *April* 2. *Great earthquake in Chili, followed by heavy rain Santiago, Valparaiso, and other cities suffered. Eruption of Mount Pelée.*

1902, *April* 19. 8.25 *p.m. (local time), disastrous shock. Western Guatemala and the richest city in the country, Quezaltenango, were completely destroyed. About* 1000 *lives were lost. The intensity of the vibrations was such that they spread over the whole of the world, and it may be inferred that this commenced an adjustment in Cordilleran fold. The effect of this adjustment apparently spread to the Antillean fold, and about the date (certainly on April* 25) *Mount Pelée showed a plume of vapour, and small earthquakes were felt in Martinique and St. Vincent. From this time the symptoms of volcanic and seismic activities became more and more pronounced, until May* 7 *and* 8, *when they culminated with submarine disturbances and terrible explosions in Martinique and St. Vincent.*

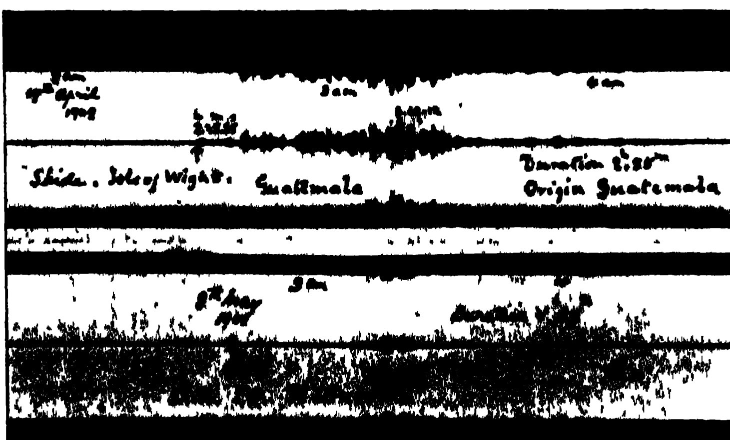


FIG 2.—RECORD OF EARTHQUAKE WHICH LED TO THE WEST INDIAN ERUPTIONS, AND RECORD OF EARTHQUAKE WHICH OCCURRED DURING THE ERUPTIONS.

From the fact that the vents in these two islands, which are separated from each other by a distance of 87 miles, practically commenced their various eruptions at about the same time, the inference is that they are both affected by a general movement of the Antillean ridge. Something similar to this took place in 1883, when, by the eruption of Tarawara, New Zealand lost its Pink and White terraces. Four or five days later White island in the Bay of Plenty became active, and two months later there was an eruption, 1200 miles to the north, in the Togan group, which islands, with the Kermadecs and New Zealand, forming, according to Dana, one of the feature-lines of

the earth's crust (see *Am. Jour. of Sci.*, March, 1889, "On the Origin of Deep Troughs of the Oceanic Depression," by T. D. Dana).

From the following table, which is chiefly compiled from the writings of Rockstroh and Fuchs, it will be noticed that *all* the West Indian eruptions have been accompanied by unusual seismic disturbances either in the West Indies themselves or in neighbouring rock folds:—

DATES OF VOLCANIC ERUPTIONS IN CENTRAL AMERICA AND THE WEST INDIES.

1552	1699	1785—	1852—
1526—	1705—	1797 × —	1853—
1541	1706	1798—	1854—
1565—	1707	1799—	1855—
1581	1709—	1802 × —	1855—
1582—	1710	1803	1856—
1585-6—	1717—	1809—	1857—
1614	1718 ×	1812 × —	1858—
1623	1723	1821—	1860
1643	1726	1828	1865
1651—	1732—	1829—	1867—
1664	1737—	1833	1868
1668—	1764	1835—	1869—
1670	1766 × —	1836 × —	1870
1671	1770	1844—	1873
1677—	1772	1847—	1880—
1686	1775	1850	1883
1692 × —	1775	1851 × —	1902 × —

West Indian eruptions are marked ×.
Unusual seismic disturbances are marked —.

One inference to be drawn from the above notes is, that if dormant volcanoes in a state of volcanic strain may be brought into activity by a mass-displacement of the fold from which they rise, small earthquakes, of which we will show that at least 30,000 occur yearly, do not give rise to such disturbances. Mount Fuji in Japan has now been dormant for the last 195 years, during which time it has been subjected possibly some 15,000 times to such shiverings, and yet it is quiescent. There may be many hundreds of similar mountains in this world, whose internal pressures are in all probability gradually increasing. Should a stage be reached when this is barely balanced by the restraining influence of an external cover, it is easy to imagine that some macroseismic effort may destroy the equilibrium, and eruptions follow.

Macroseisms and Magnetics.

With the object of learning whether any relationship existed between world-shaking earthquakes and unusual movements of magnetic needles, in 1897 I sent a list of large earth-movements which had known origins to 32 different magnetic observatories, asking that the same might be compared with their magnetograms. Detailed replies received from 13 of these observatories are published in the *British Association Reports* for 1898 and 1899, to which general remarks about

observations at other stations are added. The inferences to be derived from these replies are as follows:—

1. At Greenwich, Kew, Falmouth, Stonyhurst, Pola, Vienna, Copenhagen, and Toronto, the magnetic needles are seldom, and then only very slightly, disturbed at the time of large earthquakes. For the Toronto instruments this statement, however, is only true for the time they were installed in Toronto. Since they were removed to Agincourt, which I believe is about 10 miles from Toronto, the same instruments have frequently been disturbed at the time of earth-movements.

2. At Utrecht, Potsdam, Wilhelmshaven, Bombay, to some extent at Batavia, and now at Toronto, the magnetic needles so frequently respond to the unfelt waves of large earthquakes that their records have been of value to the seismologists.

3. At Zikawei, Mauritius, Utrecht, Greenwich, and Japan, perturbations of considerable magnitude have been observed a short time before the occurrence of large earthquakes.

One explanation which may be offered for this marked difference in the behaviour of magnetic needles at different stations is to assume that there is a considerable difference in the mechanical movements experienced at different stations, dependent, perhaps, upon the differences of their foundation and the differences in distance from the origin of a given disturbance. When, however, we note the difference in behaviour of instruments at Toronto and Agincourt, or at Copenhagen and Wilhelmshaven, which are practically at the same distance from the origin of many large earthquakes, the latter explanation fails. Again, if we consider foundations, we find that perturbations occur at Wilhelmshaven but not at Copenhagen, which are both situated on the plain of alluvial drift which stretches from Holland eastwards into Russia. Another suggestion is that the periodic motion of needles at certain stations may synchronize with the period of the earth-waves. What we, however, find is that, although the unifilar periods at Potsdam and Kew are practically identical, at the former station perturbances are common, whilst at the latter they are practically unknown. Also it must not be overlooked that, although the periods of "unifilars" at the stations considered usually vary between 5 and 14 seconds, whilst the "bifilars" vary between 5 and 18 seconds, almost all large earthquakes yield groups of waves which will coincide with any of these periods, and therefore if earth-waves cause magnetic needles at one station to rotate through arcs of from 1 to 7 minutes, showing on the photographic film displacements of 2 to 15 millimetres, similar perturbations might be expected to occur at all other stations.

The maximum tilting to which magnetometers are subjected when they indicate the above movements as a maximum, may be taken at 10 seconds of arc. This means that a needle with a 12-inch suspension has its point of support moved about the one-hundredth of a millimetre,

and this with a period of from 10 to 20 seconds. Whether this minute and exceedingly gentle disturbance is sufficient to set up the *rotations* observed is a matter which might be answered by experiment.

From the above remarks, it therefore appears premature to conclude that the movements under consideration are due to mechanical causes. The next suggestion is that the cause is magnetic. Inasmuch as large waves are propagated over long distances with a constant velocity, and cause a heterogeneous crust over a considerable area to move uniformly, it may be assumed that such waves are propagated in a uniform medium, which lies beneath the crust of the Earth. With such conditions, it is most likely that magnetic disturbances will be most marked at those stations which are nearest to the moving *magnetic* mass, the differences in distance between a given set of stations and this magma being the difference in thickness of the intervening crust at these various stations. The reason for qualifying this magma as magnetic rests on the fact that most volcanic materials which reach the surface of our Earth are magnetic in character, and the disturbing influence which certain volcanic eruptions have apparently had upon magnetic elements, has frequently been recognized (see 'Seismology,' p. 223, Int. Sci. Series).

If such an explanation as this is true, then in the vicinity of the stations where earth-waves produce marked disturbances of magnetic needles we should expect to find evidence of the existence of a hidden chain or mass of unusually dense material. In other words, the value of g as observed at these stations should be greater than at those stations where magnetic needles are not disturbed—*cæteris paribus*.

With the object of determining whether it is worth while making a close investigation of this suggestion, Dr. Charles Chree, F.R.S., very kindly furnished me with a list of observed and calculated values for g abstracted from the work of the Austrian Marine (*Veröff. des Hyd. Amtes der k.u.k. Kriegs Marine in Pola*, No. 14, Pola, 1902). From them I make the following selections as referring to stations where there are magnetometers; g is expressed in metres per second; Helmert's formula $\gamma = 9{\cdot}780(1 + 0{\cdot}00531 \sin^2 \phi)$ is used for theoretical values, and Oppolzer's determination, $g = 9{\cdot}80876$ at Vienna, for standard value:—

Place.	Latitude.	Observed and reduced to sea level, etc., g.	Calculated γ.	$g - \gamma$.
	° ′ ″			
Pola	44 51 48	9·80648	9·80584	+ 64
Melbourne, 1893 ...	37 49 54	9·80013	9·79954	+ 59
" 1894 ...	"	9·80019	"	+ 65
Bombay	18 53 48	9·78655	9·78545	+ 110
"	18 55 23	9·78663	9·78546	+ 117
Batavia, 1893 ...	6 5 48	9·78193	9·78059	+ 134
" 1894 ...	6 11 0	9·78195	9·78060	+ 135

For the two latter stations where magnetic needles are disturbed, it would appear that the value of $g - \gamma$ is about double that which it has for the two former stations where marked disturbances have not been observed.

At several other magnetic stations like Greenwich, Kew, Zikawei, where magnetic needles are practically undisturbed at the time of large earth-waves, the values for $g - \gamma$ are of the same order as those given for Pola and Melbourne. Add to this the fact that the pendulum has revealed the existence of a chain of dense material crossing India to the north of Bombay, and the suggestion that seismometrical and gravitational investigations may possibly have a relationship is at least deserving some consideration. If an earthquake is preceded by chemical, physical, or mechanical changes in such a magma, this might throw light upon the observations at Zikawei, Mauritius, Utrecht, Greenwich, and in Japan. A second inference is that if needles at Utrecht, Potsdam, Wilhelmshaven, Bombay, and Batavia are disturbed by changes in a magnetic magma in their vicinity, Dr. J. E. Murray points out that at those stations magnetic intensity might be abnormal. This, however, is only true for the two latter stations.

Large Earthquakes and Small Changes in Latitude.

In the 'British Association Report for 1900,' p. 107, there is a table which, for the years 1895 to 1898, shows the number of large earthquakes which took place every successive 36·5 days. Opposite to each of these entries the pole-displacements are recorded. Those which are measured from a figure given by Prof. Th. Albrecht, of Potsdam, represent one of the results obtained by the International Association of Observatories now engaged in the determination of variations in latitude. The figure, somewhat extended by previous observations, is to be found in 'Die Veränderlichkeit des Geographischen Breiten,' a paper by Dr. Albrecht, published by the International Geographical Congress held in Berlin in 1899.

What the table shows is that when the pole-displacements have been relatively large, world-shaking earthquakes have been numerous, and *vice versâ*.

In the yearly totals this is marked. Thus—

In 1895	there were	9	large earthquakes	and a *total*	displacement	of	0″·53
„ 1896	„	18	„	„	„		0″·91
„ 1897	„	44 or 47	„	„	„		1′·07
„ 1898	„	30	„	„	„		0″·79

It is not supposed that the molar displacement these earthquakes represent were sufficient to cause the polar change, but, as pointed out by Prof. H. H. Turner, it seems possible that both may result from a common cause. Until further comparisons have been made, it is, however, somewhat early to formulate hypotheses.

II. Microseisms, or Small Earthquakes.

The number of shocks recorded annually.

Mallet, in his Report to the British Association, 1858, p. 51, says that between A.D. 1001 and A.D. 1850 the average number of earthquakes noted per year in the world was 7·7. Between A.D. 1551 and A.D. 1850 it was 17·3, whilst between A.D. 1701 and A.D. 1850 it was 35·3. The conclusion drawn from these and similar figures is not that seismic activity is increasing in the world, but that observation has become more general. From Fuchs' 'Statistik der Erdbeben' we learn that between 1865 and 1884 the number of earthquakes recorded in the Northern Hemisphere only was 8133, which represents an average per year of 428. If we turn to still more recent catalogues, as, for example, those brought together by F. de Montessus de Ballore, we find the annual frequency for the world given as 3830. Although this number is large, its author regards it as being far below actuality. For many countries in the world earthquake records are not kept, and in those where they are kept, with but few exceptions, the registers are far from perfect. Then, again, all our catalogues refer to shocks which have been felt upon the land, whilst those which have had suboceanic origins and never reached the land necessarily remain uncounted.

In order to form some idea of the average number of shocks which take place annually, all that we can therefore do is to make estimates based on various hypotheses.

1. As the result of an elaborate seismic survey yet in progress in Japan, we know that in this country, and chiefly along its seaboard, about 1000 shocks are recorded every year. We also know that the number of world-shaking earthquakes which originated on the flanks of the Japan fold in 1899, 1900, and 1901 was 29 (see map, p. 108).

During that same period in the world there were at least 168 disturbances, approximating in magnitude to those originating in the Japan districts. Now, if the number of small shocks recorded in a country is proportional to the number of larger shocks, then the total number of shocks which occur annually would, for the districts considered, be about 6000 for world-shaking earthquakes originating on land. We have, however, learned that the number of after-shocks recorded at a given station depends upon the distance of that place from the origin of the original disturbance. After the great earthquake of 1891, the after-shocks recorded at distances of 17, 36, and 60 miles from its origin were, as pointed out by Dr. Ōmri, 4500, 2000, and 140 to 350. Bearing in mind the fact that the majority of the Japanese records refer to disturbances originating many miles off its coast, it is reasonable to suppose that very many earthquakes occur which fail to reach its shores. Were it possible to record these, it seems certain that the frequency for

the Japan district, and consequently the frequency for the world, would be increased several fold.

2. If it is assumed that the number of earthquakes which occur in any larger section of the globe, like a continent, is proportional to its area, and if we know the average number recorded in one of these sections, we have evidently the means of estimating the number of earthquakes which may be expected to occur in other sections of the world. In the following table we have the average earthquake frequency for the continents as given by Ballore, the ratios of their areas, Europe being taken as the unit, and the expected numbers of earthquakes on the assumption that the yearly frequency for Europe is 2000—this latter continent being selected as the basis for calculation because its seismicity is best known:—

	Observed average frequency.	Ratio of areas.	Expected frequency.
Europe	2027	1	2000
Asia and Japan	733	5	10,000
Africa	69	3	6000
North America	561	2	4000
South America	164	1 8	3600
Oceania	269	1	2000
Total	3823	—	27,600

3. Inasmuch as the ratios of the areas of seismic activity to those of the aseismic districts may be very different, a closer estimate may be obtained if seismic districts are taken by themselves. As a unit district we may take Greece, Turkey, Austria, Italy, Switzerland, South Germany, and South France. In this district, M. Ballore's figures indicate that the annual frequency is 1900. On a globe 50 centimetres in diameter, this area is equivalent to that covered by a strip of paper 16 × 2 centimetres. With this last area as unity, the ratios of the seismic areas in other parts of the globe and the number of earthquakes which may annually occur in the same are as follows:—

	Ratio of areas.	Frequency.
Central Europe	1	1900
Asia and Japan	3 5	6650
South of Japan to Java, and Sumatra to New Guinea	2 5	4750
North of Japan and East to Alaska ...	1	1900
North and South America	4	7600
Africa	0 5	950
West Indies, New Zealand, and other parts of the world	1 0?	1900
	—	25,650

Nearly all large earthquakes are followed by a long series of "after-shocks." These, which are most frequent in the epifocal area, are regarded as sudden settlements and adjustments on the fault plane or planes created at the time of the primary disturbance. After the disturbance of October 28, 1891, which had its origin in Central Japan, and which may be regarded as a typical world-shaking earthquake, during the first twelve months 2956 shocks were noted. In the year following this number had decreased to 391. If we assume that each of the 50 large earthquakes which annually disturb the world give rise to 500 shocks during the following year, whilst the 50 primary disturbances of the preceding year are represented by 50 after-shocks, then, without considering the after-shocks of still earlier years, the conclusion arrived at is that in any given year there are at least 27,500 which could be recorded in epifocal districts.

Although the above estimates result in large numbers, it seems likely that on the average every year 30,000 earthquakes take place, each of which disturb 10 up to several hundreds of square miles of the Earth's surface, and would be sufficiently intense to be felt by many people.

Relation of Microsciems to Earth Structure.

As stated in the introduction to this paper, microseisms may for the most part be regarded as settlements along lines of fissures and amongst disjointed materials, the first formation of which was in all probability macroseismic in character. Some, no doubt, are initial stages in primary fissuring, but the majority, when traced to their birthplace, find an explanation in some slight shift on the line of an existing fault. For Great Britain Dr. Charles Davison has done most excellent work in tracing local earthquakes to this latter cause. The Comrie earthquake of July 12, 1895, like many which preceded it, Davison shows came from the highland border fault, and as the disturbed area is chiefly on the north-west side of this fault, the probability is that it hades in this direction. In other instances he has shown that a fault has been extended in its length, whilst at other times the existence of a fault has only been inferred. Not only has this work extended our knowledge of the cause of certain earthquakes, but it has also increased our knowledge of the changes which are taking place in structural geology. Of these changes there are about thirty thousand per year. Individually they seldom produce any effect visible on the surface of the Earth, but each represents some small subterranean movement about the cumulative effects of which we can only speculate.

III. Utility of Seismograms.

From seismograms obtained in epifocal areas, measures of earth quake energy expressed in mechanical units have been obtained. One result of this has been that engineers and builders in earthquake-

shaken countries now build to withstand known forces. In Japan it has been repeatedly shown that bridges and buildings constructed according to European practices are unable to withstand the severe shakings which so frequently occur in that country, and therefore, as opportunity presents itself, the old types of structure are being replaced by forms which experience has proved are not so readily disturbed. The importance of seismology is so far recognized by the Japanese Government that at its University we find a professor and assistant professor of this subject, whose duties in part consist in giving to students of engineering and architecture a course of instruction bearing upon their future profession.

The Government also support a bureau, controlling about one thousand stations, and in addition to this they grant an annual subsidy to a committee consisting largely of practical men, whose duty consists in making investigations which will lead to the mitigation of earthquake effects. Not only does this body investigate destruction which from time to time occurs in Japan, but should a disaster take place in Manila, India, or some distant country, a commission is despatched to report upon that which fell and that which remained intact. By this means Japan has become a repository for almost all that is known about applied seismology, which already has been the means of saving life and property. Seismograms of unfelt earthquakes not only explain certain irregularities in magnetograms, but they also throw light upon abnormal movements in the records from electrometers and barometers. Apparent changes in the rates of timekeepers have frequently been traced to earth-movements, the occurrence of which would not be suspected without the aid of seismograms.

It has often happened that cables have been destroyed by submarine earthquakes, and to know the cause of such interruptions is of great importance, especially to communities who have, by such occurrences, been suddenly isolated from the outer world. The breaking of cables has been regarded as an operation of war, with the result that military and naval preparations were made, expenses of various descriptions were incurred, and naturally there was much alarm, all of which would have been avoided by the inspection of a seismogram (see "Sub-oceanic Changes," *Geographical Journal*, August and September, 1897).

Seismograms, we have shown, enable us to locate submarine sites where it would be rash to lay a cable. Lastly, they enable us to confirm, correct, extend, and occasionally to disprove messages that come by cable describing seismic catastrophes in distant countries.

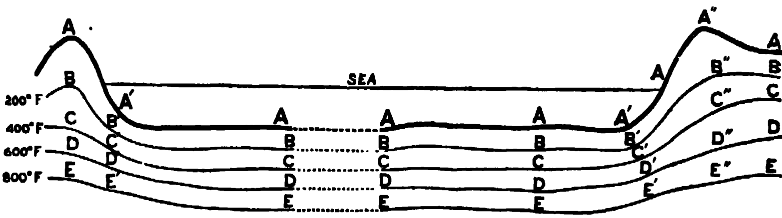
After the reading of the paper, the following discussion took place:—

Dr. Blanford: I have listened with very great pleasure to the address of Prof. Milne, and I am not competent, even were I disposed, to criticize his observations. In this inquiry Prof. Milne is endeavouring to solve what has always

been a great problem for geologists—the origin of the movements that affect the crust of the Earth, and the effect of those movements upon the forms that are assumed by the surface of the Earth both on the land and under the sea. And, to a certain extent, there is no doubt that he and others who have studied the subject have succeeded. We who have spent a great part of our lives in the study of geology, are acquainted with numerous dislocations of the Earth's crust; they are of very frequent occurrence, and are known by a term—faults—originally employed by miners. Now, I think one of the most important facts that have been demonstrated is that when these fractures in the rocks near the surface of the Earth are formed, they are attended by earthquakes. The original cause of the fractures is in need of further elucidation. Prof. Milne has explained that there are large and small earthquakes, and some of the largest earthquakes seem to have been accompanied by similar movements to the small seismic disturbances. There has been a general acceptance of the view that surface changes, such as elevation, depression, and dislocation, the formation of mountain ranges, and the disturbance of the rocks forming the Earth's crust, are due to the shrinking of the Earth's interior, in consequence of loss of heat, and to the consequent pressure on the crust, which, having already cooled, cannot shrink with the interior. The loss of heat is in all probability one of the causes of the lateral pressure which results in disturbed and fractured strata, but it is very doubtful whether it is the whole explanation, some local cases of compression appearing too great to be explained by subterranean loss of heat alone. Changes in latitude to which Prof. Milne has called attention may be cumulative, and may in past times have been of considerable amount. Another curious and interesting question to which Prof. Milne briefly alluded is the effect of magnetism. I can only say, before sitting down, that I think we are all very deeply indebted to Prof. Milne for giving us a lucid account of a rather obscure subject.

Prof. PERRY: I have been called upon to speak, probably because I have had a sort of connection with Prof. Milne for a good many years; he has harnessed me and many other people to the waggon he is drawing; in spite of my ignorance, he compels me to act as a member of the British Association Committee on Seismology. I have not recently thought much about the subject, but when hearing this fine address, I have again been struck with the extraordinarily great velocities with which earthquake motion is transmitted through the inner earth. It is difficult to understand, but these records show that the stuff inside the Earth is a great many times more rigid than the hardest steel. We do not know what the materials are; probably there is much iron; probably much gold and platinum near the centre. It is exceedingly hot; it is under such enormous pressures that our laboratory experience is of no use to us in speculating about the properties of the stuff. But we see that the stuff is very rigid. This agrees with what we know from Lord Kelvin. He has shown from tide phenomena that not merely for these quick motions of periods like one second, but for quite slow changes in distortional force, of periods like a day or a fortnight, the Earth is at least as rigid as if it were steel. Here is a stubborn fact, not difficult to understand, if we think of how a liquid Earth must have cooled to its present solid state. But with this fact before us, it is very difficult to understand why, when there are earthquakes and volcanic eruptions in one part of the Earth, they are soon followed by earthquakes and volcanic eruptions at other and distant places. There seems to be some communication between different parts of the Earth, such as there would be if the Earth were liquid inside, and we know that the Earth is not liquid inside. When lava flows from a volcano, we know that it was probably kept in a solid state by great pressure, and that its liquefaction is due to the relief of the pressure. Now, as

I listened to this paper, it came to me to think that, although the Earth is very rigid, like pitch or sealing-wax when subjected to forces of such periods as Prof. Milne and Lord Kelvin deal with, it may not be at all rigid; it may yield and flow and transmit forces like a fluid when the forces alter more gradually. At the bottom of a deep mine, even granite and other hard rocks flow under great pressures, and we know that the hardest steel can be made to flow, so there is nothing very extraordinary in our assumption that the stuff inside the Earth, under conditions of temperature and pressure such as we have no conception of, may also yield and act almost like a fluid when it has time enough. In the figure, if S is the surface of the sea, A the land's surface, the surface B shows where the rock is all at 200° Fahr., being about 2 miles deep generally, underneath the sea. The surfaces C, D, E are at 400° Fahr., 600° Fahr., 800° Fahr. As there is very much more surface area at A″, the isothermals are there further apart; as there is less surface area at A′, the isothermals are nearer.



I take it that we have as main causes of change—(1) The Earth on the whole is contracting underneath. As it contracts, the surface skin falls in, and as it resists contraction, it is in compression, and so there is a tendency to lift A″, to depress A′, and there is great tendency to fracture along the thin layers A′B′C′D′E′. This is the main cause of earthquakes at A′. (2) The great weight of the mountains, A″, causes a tendency for lateral flow towards the sea-bottom, A′, the sort of flow noticed in deep mines; this is a constant tendency to produce fracture at A′. (3) When A″ is further raised and A′ sunk, there is a diminution of pressure at E″ and an increase at E′. The percolation of water and generation of steam will tend to equalize the pressures at E″ and E′, consequently mere gravitation will act and tend to lower E″. Percolation of water through miles of rock being a slow process, the tendency of the hills to rise and afterwards sink will alter very gradually.

Below a certain depth we can imagine the stuff, under enormous pressure and temperature, to be capable of transmitting pressure like a fluid if sufficient time is allowed. Hence an elevation or a depression of a region in mid-ocean, where the surface rock is more yielding than elsewhere, may cause diminution or increase of the existing pressure at places underneath A′, A′, more or less nearly simultaneously.

Captain Creak: I do not know that I can say very much on this question, but, at any rate, I may congratulate Prof. Milne on having given us a very interesting paper. I think that both magneticians and those who study seismology will eventually have much in common, for I consider that, on the whole, Prof. Milne has established one point—that the disturbance of magnets he has noticed was not caused mechanically by the shaking of the Earth or by tilting; he has fairly established that. We know perfectly well that iron and steel, when subject to stress or vibration, are liable to change of their magnetic condition, and we may also infer from this that magnetic rocks that have no motion of translation, when subject to stress are also subject to change of magnetism; it is stress which causes

the change in the magnetism of the Earth, and consequent disturbance of the magnetic needle. I have been to Shide, and have seen Prof. Milne's apparatus there, and I was particularly struck with the delicacy of those instruments. He made fast a thread to the top of a lamp-post such as we have in the street, that lamp-post being embedded firmly in the chalk. The smallest pull on that thread was most beautifully marked upon his apparatus. You could tell the slightest motion. Now, I do not think any of our magnetometers would be shaken in that way, so I am rather inclined to think he is right in saying it is not tilting, and I hark back upon the compression as being the cause of the needle disturbance. Then the lecturer spoke of the differences between different observatories. I think he is perfectly right in saying it is the density of the mass below some observatories which causes the magnetic change when it is subject to compression. In others there is no magnetic mass to compress. If we go to Edinburgh, I can imagine the volcanic rocks being exceedingly compressed during an earthquake. That is a direction in which we should make further inquiry, and I think Prof. Milne has been so far wise in calling this question of magnetism to his aid, and I hope he will continue to work with magneticians.

The President: I think the meeting has listened with very great interest to the splendid paper which has been communicated to us by Prof. Milne. In the name of the Council I must congratulate him, in the first place, on his apparently great success in establishing or getting established, in various parts of the world, the observatories which are so necessary for the advancement of his investigations. We should have been glad to have furthered his views, and I myself did make some efforts to assist him some years ago in that way. I see that we have three or four observatories in North America, and two in South America, which are registering the phenomena of earthquakes. I have no doubt, therefore, that Prof. Milne will be able to collect all the existing records on the subject. Some years ago now, I remember making a list of earthquakes on the west coast of South America, going back three centuries, and since that time I note that a much fuller and more elaborate list has been made of the same phenomena along the west coast. I have no doubt similar records may exist in other parts of the world. It only remains for us now to accord a unanimous vote of thanks to Prof. Milne for his most valuable and interesting paper.

NOTES ON THE COUNTRY BETWEEN LAKE NYASA AND VICTORIA NYANZA.*

By OTTO L. BERINGER, Assoc. M. Inst. C.E., F.R.G.S.

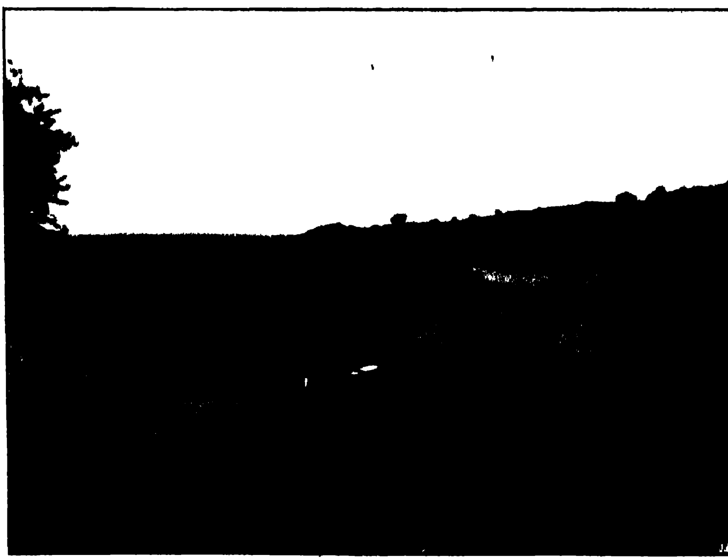
The surveys on which the accompanying route-map is based were carried out between the years 1897 and 1901. No astronomical observations were made, the positions of Karonga and Abercorn being taken from the observations of the Anglo-German boundary commissioners, and Kisumu from the Uganda railway survey.

The work was done throughout for the African Trans-continental Telegraph Company, the author being their chief surveyor. As far north as Ujiji preliminary surveys were made by plane-table, and these were subsequently corrected from the survey of the telegraph line,

* Map, p. 108.

carried out with a 5-inch theodolite and chain. Between Ujiji and Kisumu the map cannot be classed as other than a route-sketch, a prismatic compass, watch, and aneroid barometer being the only instruments used.*

Much has already been written, both as to the physical aspect and the native inhabitants of the country between Usisia and Kituta at the south end of Lake Tanganyika. Particularly striking is the rocky and mountainous nature of the coast north and south of Usisia, terminating in the former direction at the well-known precipitous landmark, Mount Waller, whence, as a reference to the map will show, the mountain range trends inland, so that if we start from Karonga, along the Stevenson road, we meet with it again at Mount Viraule. Apart from



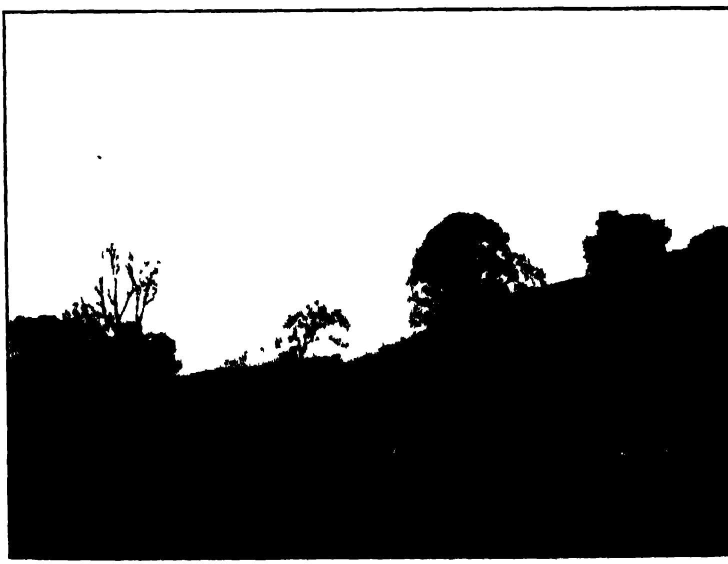
WEST LAKE NYASA, NKATA BAY.

isolated ranges of hills, the intervening land is very flat, and shows at different elevations three and four different old coast-lines, which prove

* Mr Beringer plotted his plane-table survey, Usisia to Ujiji, on the scale of 1 : 250,000, and his prismatic-compass survey, Ujiji to Kisumu, near Port Florence, on the scale of 1 : 500,000. The prismatic-compass survey was enlarged to the scale of the plane-table survey and laid down on a sinusoidal projection, fixing one end at Kisumu. The plane-table survey was also laid down on the projection with one end fixed at Abercorn; the other met at Ujiji, and the point of meeting fell within some 3 minutes of longitude of the position observed by Mr. Fergusson and Dr. Kohlschütter. As this position (29° 40′ 12″) is about 20 minutes westward of the hitherto accepted position, the coincidence is not only remarkable, but supports the accuracy of the very arduous piece of work successfully accomplished by Mr. Beringer.

the lake to have at one time approached, or even actually washed, the base of this range, leaving the hills, such as those directly north of Deep bay, as islands. Whether the present conditions are owing to the upheaval of this part of the lake or its secular drying up must be left to the theories of others; certain, however, it is that the forces concerned reach their maximum of activity at long but well-defined intervals. The sharp and rocky pinnacles bordering the Nyika plateau as seen from Karonga are indeed magnificent, many of the towering and needle-like points being quite inaccessible.

The Tanganyika plateau traversed by the Stevenson road reaches its highest points at Mambwe and at Fwambo pass near Abercorn, the



CORNFIELDS, LIVINGSTONIA MISSION, NEAR MOUNT WALLER.

former being on the watershed between the Saisi river draining into Lake Rukwa, and the Chambezi draining *viâ* Lakes Bangweulu and Mweru into the Congo; the latter on that between the Saisi and Tanganyika. Hills and mountains rising right and left of the Stevenson road make the scenery at places and at certain times of the year very beautiful. A peculiar sensation is felt by those unused to the climbing of plateau slopes in ascending from Karonga: what look like mountain peaks are, when passed, no longer visible, and this occurs from step to step, as it were, for some 40 miles, until the higher slopes of the plateau proper are surmounted, and the hills and mountains, quite to one's satisfaction, are found to be genuine all round. The road has to a great extent been reconstructed, and waggons can run freely

from Fort Hill to Tanganyika. The chief stations in this part of the territory may be here enumerated. On Deep bay, Lake Nyasa, there is a station of the British Central Africa Administration, usually filled by one European only. The following occur along the Tanganyika plateau road: *Karonga*, where is stationed a collector of the B.C.A.A., contains several stores, an operating station of the African Trans-continental Telegraph Company, and a branch of the Livingstonia Mission, the headquarters of which are at Kondowe, behind Mount Waller. *Fort Hill* is a sub-collecting station of the B.C.A.A., with usually one European resident. Then, as we cross the Nyala stream into North-Eastern Rhodesia, we reach *Nyala*, a sub-collecting station; but, owing to its seemingly unhealthy situation, no European resides there. *Fife*, where a small township has been laid out, is inhabited by several officers of North-Eastern Rhodesia Administration, an operator of the A.T.T.C., and several storekeepers and traders. A few miles further on, and on the left of the road, is a station of the London Missionary Society; and then shortly a very substantial station belonging to the African Lakes Trading Corporation, usually the quarters of three Europeans. *Mambwe*, formerly a mission station of French Catholics, was made into a sub-collecting station of the N.E.R.A., then sold, and has now no fixed resident, but is much used as a resting-place; it is situated over 5000 feet above sea-level, and during the months of June, July, and August is very bleak.

Kawimbi, another station of the London Missionary Society, is next met with. It contains a church, school, shops, and houses for the three or four Europeans stationed there. Gardening and carpentry are taught, and the excellent results in both departments are very much appreciated by the residents at Abercorn and elsewhere; nor should the hospitality and medical care ungrudgingly given by its inmates to the numerous Europeans continually calling, be passed over without commendation. *Abercorn*, another township, situated some 14 miles from the south end of Lake Tanganyika, comes next. It is a large and important station, the quarters of a collector, assistant-collector, and other officers of the N.E.R.A., and has a telegraph office of the A.T.T.C., besides stores and offices of several trading companies. Near by is Lake Chiuta, a small and picturesque sheet of water, the haunt of many ducks and geese and other wildfowl. Eight miles further on the road commences to descend, and *Kituta*, on Lake Tanganyika, is reached, or, by branching to the left, the new station of *Kasakalawe*, also on the lake. Between Kituta and the lake proper a mile of low flat country intervenes, sandy and difficult to walk on in the dry season, and a quagmire in the wet. Kasakalawe, on the other hand, has the advantage of a dry and well-timbered shore, with deep water a few feet off it affording a satisfactory shelter, and is altogether a far superior place to the older Kituta. At both these stations Europeans reside.

The Tanganyika plateau is well timbered, though the trees are not usually of large circumference. In places, such as the ravines of some of the mountains and the surface of the Msuku uplands, areas of virgin forest exist, and generally along the banks of the larger streams trees of immense girth grow. A prominent exception is formed by the banks of the large and swampy Saisi river, where, on account of the flatness of the land and the ill-defined banks, the country is usually flooded, this preventing the growth of anything but reeds and grass. The population is peaceful, but close to the main roads it is practically *nil*. The usual food-stuffs, such as maize, millet, sweet potatoes, peas, beans, etc., are

TANGANYIKA PLATEAU

grown. Game is fairly plentiful off the roads, and much slaughtered by the natives by means of pits.

Leaving Kituta and following the lake round the south-east corner and north to the German station of Bismarckburg—formerly Kasanga—we find the country to be generally broken and mountainous, more especially after crossing the Anglo-German boundary at the Kalambo river, from which point it was found impossible to take the telegraph-line into Bismarckburg without climbing over 1000 feet to a step of the plateau, and then descending again very steeply. A few miles from the mouth of the Kalambo river very magnificent falls occur, a large volume of water falling a sheer 600 feet or more over a rocky lip of horseshoe shape. It then winds in a silvery line through a gradually widening but impenetrable valley with progressively lower cliffs until it reaches the lake. It is thus impossible to see the falls except from above, but

the somewhat steep and rugged climb to the upper plateau will always well repay the exertion, as plenty of water flows all the year round. No finer falls, not excluding those of the Ruo, have been seen by the present writer during the ten years he has spent in Central Africa.

Bismarckburg, which is shut in on all sides by mountains, is the southernmost station of the German East African Administration on Lake Tanganyika. A fine well-appointed boma or fort is now being built, and there are quarters for about five German officers and non-commissioned officers, besides a few traders and a number of Sudanese and other soldiers. As at Kituta, the heat is at times almost overpowering—at least, to those whose duty takes them away from the comparatively cool verandahs. On the coast between Bismarckburg and Ujiji there are four stations—Kala, Kirando, Utinta, and Ujiji—all occupied by the Algerian "White Fathers," and possessing fine churches, schools, and other stone buildings.

It was soon apparent that the telegraph would once again have to scale the mountains and reach the plateau, the coast-line north of Bismarckburg being quite impossible. This plateau I found very beautiful, being high, well watered, and grass-covered to a large extent, with pretty hills covered with grass and trees rising on each side; the country seemingly fertile, but somewhat sparsely inhabited. I travelled first along the country to the east of the telegraph-line, following a native path; but, finding the Fwisi and its tributaries very swampy, I decided to keep on somewhat rougher country to the west, more nearly on the watershed between Tanganyika and the Fwisi, which flows into Lake Rukwa. As it was imperative to again skirt the lake at Karema, I had reluctantly to leave this high ground when east of Kirando, and gradually descend again through fairly well-timbered country. The natives of this district are well clothed, being supplied by the Arabs with coloured cloths, white calico, and beads, in exchange for the rubber collected by them, mostly in the virgin forest which fills up the ravines draining into Lake Tanganyika. There was hardly a village where two or more of these born traders were not found. As is the case with nearly all the mountain-girt lakes of Central Africa, the tribes inhabiting the shores are different from those on the higher mountain slopes or plateaux, and were it not for the presence of officials at Bismarckburg and Ujiji they would be constantly raiding and counter-raiding as of old. As it is, they now carry on a more or less friendly barter of fish on the one hand for salt and iron on the other. North and east of Karema is a wide and comparatively flat country, generally well-timbered, but swampy here and there in the rainy seasons and waterless in the dry. Mimosa-thorn trees abound, and giraffe are plentiful. On the lake and in the neighbourhood of Katunka's the population is large. This Katunka is a powerful chief, noted for the murders he has committed, and is a constant source of trouble to the German officials.

The rough nature of the country north of Katunka, together with the configuration of the lake-shores and the swamps between Karema and Katunka, again necessitated the continuance of the survey on the higher land, and only after a wide extent of country had been examined was it possible to get the better of the swamps, virgin forests, and a number of extraordinarily deep ravines or cañons that had to be manœuvred between Kapurola and Mulire. The natives, too, gave constant trouble, numbers not having seen, and few having before worked for, a white man. They preferred hunting the large herds of elephants and other game roaming about, or collecting rubber, to the more monotonous and restricted work demanded by Europeans, and, being well armed, they

LAKE TANGANYIKA, KITUTA.

had no hesitation in saying so. They are well clothed in Arab clothes, own a few cattle and large herds of goats and sheep, while their villages are extremely well stockaded. They do not paint, but the women wear large ear and lip rings. Kapurola is a big and quarrelsome chief, and has likewise given considerable trouble to the Ujiji officials. When last seen by the author he was a refugee a few miles up the right bank of the Luajeri river, on a small rising ground surrounded by an almost impenetrable swamp of reeds.

The Lugufu, Malagarasi, and Liuchi rivers all overflow their banks and are very swampy in the rainy season. The Malagarasi is probably the largest river flowing into the lake. All these rivers are full of crocodiles and hippopotamuses, which in the rainy season are found near their sources.

Between Maswa and Ujiji the population is large, and the country by the lake opens out, terminating at Ujiji in undulating ground. This, however, is much cut up by sharp and comparatively deep ravines, the nature of which can only be judged by walking over the country away from the winding but well-engineered paths of the natives. All along this coast swamps at lake-level lap into the land —just dry from July to November and December, and impassable the rest of the year.

Leaving Ujiji in August, 1901, the expedition crossed a minor but still swampy branch of the Luichi river, and after getting over some low but very broken country, the Luichi itself, at a place where it had a considerable fall, with well-defined banks and no overflow. Then a mountain with steep face was climbed, and a lovely and cool plateau reached, densely populated, well watered, and supporting large herds of cattle. The natives were friendly, wore skins and copper and wooden bracelets, of which, however, the latter only were seen by the author. Their huts were particularly well constructed, and not stockaded. A descent was made somewhat abruptly, and with much reluctance, to the valley of the Msukwe river, the country then alternating between grass-covered and well-wooded land, until the Malagarasi was reached on August 31. It seemed scarcely smaller than when crossed at its mouth. After crossing the river and following up its left bank for some distance, sometimes on dry and other times over muddy land, our route left it, and some undulating, well-timbered, but quite dry country was crossed. This brought us to the Mugana river, quite dry at the time; and a few miles further on the Mtindi was crossed. This, in the wet season, is in itself 5 miles broad, and forms a huge swamp, extending down to the Malagarasi and up-stream for some 50 or 60 miles or so from this crossing. The Mtindi was crossed at a favourable place on September 6, and even here, before the other side was reached, seven channels had to be crossed, the largest 300 yards in width, and with 4 feet 6 inches depth of water. In the rainy season, the entire country between the Mugana and the Mtindi river is under water—a width of 14 miles, with a maximum depth of 7 feet. The Mtindi never dries up, and is only fordable at one or two places for about three months in the year. This far from pleasant natural barrier divides the people of Uha on the right bank from the Wasumba and Wahinga tribes on the left.

Between the Mtindi river and the south of Smith sound of the Victoria Nyanza, the country is, apart from the paths and native clearings, largely covered with an almost impenetrable thorn scrub. The trunks or limbs of the bushes are up to 8 inches in diameter, with thick minor branches and shoots, the whole densely interwoven and covered with very formidable thorns. In the dry season there is no surface or running water whatever, the natives all resorting to wells dug to a

depth of about 20 feet; needless to say, that towards the end of the dry season the stuff contained in them is far from refreshing. The Kagoni river is seemingly dry for five or six months during the year.

The villages are generally large and well kept, the natives peaceful and well clad. They trade largely in conjunction with the Tabora Arabs, for whom they travel great distances in search of ivory. Cattle are plentiful, and are all of the humped variety. The Swahili language is understood by nearly all the elder men, headmen, and chiefs. Between the Mtindi river and Smith sound, the author found most encouraging signs of civilization—more, indeed, than he had previously witnessed in Central Africa. The chiefs are designated "Sultani."

BAOBAB TREE NEAR SLEEP BAY

Kapula village—formerly Ghiya—was visited by Speke and Grant in 1861, and by Stanley in 1876 Here hilly country commences, the hills being well covered with timber, the plains alternating between grass and the aforementioned thorn scrub, the former swampy in the rains. Between Ngombe and Mpina villages, the country, which is drained directly into Smith sound, is dotted over with low timber and grass-covered hills. It is nearly all very rocky, with boulders of gneiss, and is so flat that practically all the plains up to the lower slopes of the hills are under water during, and for some time after, the rains. The ground crossed in September was hard baked, and so cracked that, after a careful mental calculation, the void made by these fissures was found to exceed the area of the earth surface. The heat, with the

unpleasant and distorting vibrations of the atmosphere above these parched plains, together with the enforced slowness of our progress, rendered travel anything but a pleasure. It was impossible, except at long intervals, to satisfy the intense thirst of the caravan, and then, with what! Game, curiously, was plentiful, ostriches, *Gazella Thomsoni*, and topi being most in evidence.

Further on the plains, undulating somewhat, became at parts densely populated, and immense herds of cattle were everywhere seen, all seemingly plump and in good condition, though apparently being fed only on the very dry grass then existing. At places, of course, *e.g.* at Stuhlmann sound and the other point of Smith sound, the route led close to water, and then green vegetation could be found all the year round. The natives were now found to wear little or no calico or cloth, but were more or less clothed in skins. Stony kopjes are freely dotted about this land, and huts and lean-to's are built on them. The Simiyu, a large river with flowing water, was crossed 15 miles from Nassa, a station of the Church Missionary Society. The station had then a clerical and a lay missionary, the former being away at the German station of Mwanza at the time of my visit. The buildings had seen better days, and little missionary influence seems to have made itself felt among the natives.

After a much-appreciated rest of two days, a further start was made along the shores of Speke gulf. The country soon became less flat, rising perceptibly away from the lake, and becoming covered with bush and timber. It was thinly populated except close to the lake, and seemingly dry and waterless inland. Crossing the river Balagete, in which a considerable body of water was flowing, the caravan traversed a flat, and in the rainy season swampy, country, now intersected by cracks, and then crossed the Luwana, a nearly dry but broad and deep river-bed at the foot of a mountain range. The numbers and variety of game seen in this plain were almost incredible—buffalo, gnu, hartebeeste, water-buck, topi, mswala, *Gazella Granti* and *Thomsoni*, and immense herds of zebra predominating. Climbing the escarpment, we reached Kiteresia village, and then proceeded over grassy and undulating plateau lands, well watered and thickly populated. A descent was made from Madutu village, and another very large but better-drained plain was reached, containing miles upon miles of grass land teeming with game, and, best of all, without cracks. Somewhere about the middle of the plain an island of thick thorn scrub was seen, and from it, to every one's surprise, a number of natives—afterwards found to be refugee Sotik people—issued, carrying long swords and formidable-looking Masai spears. They were nude, painted with plain and coloured clay, the men averaging over 6 feet high. They advanced towards the caravan, all the members of which, except the writer, were unarmed. This, our unwarlike appearance, and the evident surprise expressed,

together with a large quantity of meat we had with us, saved the day, as not a single word could be understood between the two parties, all subsequent communication being carried on by signs, a very humorous spectacle. Even such words as fire, water, river, common over a large area of Africa, were in every case used by the writer's cosmopolitan caravan without any sign of recognition on the part of our new acquaintances. Their hair was made up into two or three pigtails slightly erect, greased, and thickly coloured with brilliant vermilion, making a distinctly fantastic coiffure.

After climbing up the face of another very steep escarpment, the village of Mutaga was reached, and it became evident that the natives now saw a white man for the first time. Continuing along the well-watered and timbered plateau, broken by outcrops of gneiss, on which we found a fairly large population, we made another descent, and crossed a well-timbered valley drained by the large river Mala. This river was found to divide two by no means friendly tribes, for whilst encamped at Marua's village on the right bank we saw a small foraging party return from a stealthy visit to some villages on the other side, carrying spears, bows, and poisoned arrows, and having amongst their number some badly wounded men, one with an arrow through his chest. About here the topi—an antelope probably nearly akin to the hartebeeste—and marabout stocks were everywhere visible.

Another stiff climb up the face of the escarpment brought us to a large grass-covered undulating plateau, with a gradual slope towards the west, as usual well watered, and fairly thickly populated by the Walianjoka tribe, who possessed immense herds of cattle. Beyond Utende village, a well-timbered but uninhabited country was met with, and, apart from a party of professional elephant-hunters, no natives or villages were met with until the large Mori river was crossed. In this solitude large herds of elephants made their home, roaming about the country both on the level ground and on the steep slopes of the higher portions of the escarpment to the east. After crossing the Mori river we mounted gradually to the higher slopes of the plateau, which were again undulating, grassy, and especially well watered. The natives, a different tribe from those beyond the Mori, were found to be quite nude, both male and female, the former elaborately painted. Their villages were all enclosed by mud walls about 18 inches thick and some 5 feet in height, the huts primitive, and built largely of solid mud. The soil about here is of a brilliant red. Immense herds of cattle, goats, and sheep thrive well. The size of these savages, and the brilliant and variously coloured patterns painted on their faces, together with an easy and withal graceful bearing, make an imposing impression, while their countless numbers make them a formidable tribe. During this time great difficulty was found in keeping on friendly terms with the natives and at the same time feeding the

carriers; language on both sides was quite unintelligible, and, to complicate matters, calico, coloured cloth, and beads were in such plenty as to be quite at a discount among them.

A gradual descent to Kavirondo bay, with a dense population on all sides, brought us to the Kavirondo tribe proper, very similar to those of the mud walls, their dress being quite the same, while they owned large herds of cattle as before. It very soon became evident that a white man was now no longer a stranger, though not until the swampy and papyrus-grown shores of Kavirondo bay had been well rounded and Kisumu nearly reached was there any outward appearance to indicate that the great Uganda railway was already laid to within some 40 miles of the Lake, or even that white men were only a few miles in front.

Kisumu, the terminus of the Uganda railway, was reached on October 28, 1901.

THE EASTERN BORDERLANDS OF KIKUYU.*

By Captain B. DICKSON, R.A.

BETWEEN Nairobi, the capital of the Ukamba Province of British East Africa, and the Meranga district south of Mount Kenya, the country consists, for the most part, of a fairly level triangular plateau, enclosed between the Kikuyu cultivated lands on the north-west, the Kamahua and Boinzero ranges on the east, and Doinyo Sabuk on the south, though in the last direction a part of the same plateau extends to the Lukenya and Mwar hills. The surface slopes from west to east and is drained by numerous streams flowing in deep beds to the Athi or Tana. Both the Athi itself and the Thika, a tributary of the Tana, make their exit between Doinyo Sabuk and the Boinzero range, both becoming broken by rapids and flowing in deep rifts as they enter the more hilly country to the east. At the north end of the plateau the streams pass either through gorges in the Kamahua range or to the north of this. All these rivers take their rise in the Kikua (Kikuyu) hills, from which innumerable streams flow down in deep narrow gorges, and on uniting in the plain at first form papyrus-covered marshes, but are subsequently confined in regular channels, eventually dropping by waterfalls or rapids into valleys or cañons 100 feet deep and varying in breadth from 200 to 800 yards. The actual river-banks are covered with large trees, but the valley-sides are rough and rocky, covered with mimosa trees, long grass and bush, which extend for a little distance over the plain above. During the rains the streams rise to a great height, in the case of the Athi 30 feet in places, so that any attempt to make bridges, except for foot traffic, would be a costly undertaking.

* Map, p. 108.

The surface of the plateau is flat, grassy, and treeless, mostly inundated during the rains, with a black-cotton soil which cracks badly in the dry season, and, in places, quantities of small stones. Large numbers of game frequent these plains. The watershed between the Athi and Thika is almost imperceptible, but on reaching the latter, the country changes in character, the vegetation becoming quite tropical. North of the Thika the plain, which slopes a little to the north, is rougher than further south, and in the direction of Kenya, patches of long grass and stumpy trees give the country the appearance of a deserted orchard.

The Kikua hills run out towards the plain in a series of narrow spurs, with a direction from north-west to south-east, separated by gorges 100 to 150 feet deep. Wherever the surface is flat swamps are found, probably owing to the enormous rainfall, but they could be easily drained. Where not cultivated, they are covered with a thick growth of Sodom-apple and long grass, and are sparsely timbered, except along their margin, where a thin fringe of forest divides them from the plain. This, probably, once extended over the hills, but has been destroyed by the annual grass burnings. At one time all the hills were cultivated, but since the famine a few years ago, the Wakikua have moved to the west, leaving the eastern side of the highlands uninhabited, although there are still some few potato patches, and bananas still grow by the watercourses. The soil, which has been formed from the volcanic rocks of which the hills are composed, only needs cultivating to grow almost anything, while all the main streams are perennial. The climate is raw and cold at night, with heavy dew on the hills, but generally hot by day. Travelling is difficult, except by the tracks following the spurs, which the Wakikua use in visiting the plains. There is, however, a fairly good road from Nairobi to the Meruka country, and though the river gorges are an obstacle, the streams are all fordable. Fuel and wood of any sort are very scarce. There is no four-footed game, but quantities of guinea-fowl and partridges. The natives, though seemingly friendly, are apt to be treacherous. They never appear to cultivate much more than they require for their own wants, and they have consequently very little spare food to barter. The women work in the fields, but the men clear the ground, cut wood, and build houses, the boys tending the stock, which consists of cattle, goats, and sheep. The women wear leather aprons, and adorn themselves with iron or brass wire bracelets and garters, as well as with beads and earrings; but the men wear practically no clothes, except sometimes a loose blanket. They carry a spear, sword, and knobkerry, and (near Meruka and Mbirri) bows and poisoned arrows.

Owing to the hostility of the natives of Meruka, it was impossible to traverse this district thoroughly, but it appears that the passage from

the cultivated hills to the plains is here more gradual, there being no dividing line of forest.

The long range of hills which forms a wall between the Athi plains and the lower Tana valley is dry, rocky, and bush-covered, with the exception of the north-west slopes of Kamahua, which are covered with bean-fields and villages. They are thickly wooded on the east, but grassy on the west except along the water-courses. There is very little water in the dry season, and what little there is runs down on the north-east side into the Tana. There are, however, some large flats below the south-west slopes of Boinzero, which, by the aid of a few dams for irrigation, could be made into fine farm land. The hills are covered with quartz, but no sign of metals was seen.

North of the Tithara the plain gives place to small hills and valleys, with cultivation and villages interspersed with bush, which continue till we reach Mbirri. This country is not so well drained as further south, most of the valleys containing wide and deep swamps, which appear never to dry up, as they are fed by numerous springs in the hills round Kinankop. The country is very fertile, and with a little labour would grow almost anything, but there is practically no wood, only an occasional big tree, though higher up towards Kinankop large belts of forest are said to occur. In places the hills are rocky, and form precipitous gorges overhung with trees and creepers. The principal river is the Maragua, which runs due east from Kinankop. It forms a series of rapids, and on crossing the Mbirri road runs through a cañon 200 feet deep, but this soon opens out into a flat valley covered with cultivation and villages, the river being here fringed with large trees. There are a few deep fords at long intervals.

North of the fort at Mbirri is a long range of hills running from west to east, with the three prominent peaks, Katuri, Kanjuyu, and Kanbicho. It is bounded on the south by the Marathwa and on the north by the Tana, these two rivers uniting at the foot of Kanbicho. The hills are rough and rocky, strewn with quartz boulders and covered with bush, and as there is no water on them it is unlikely that they could be of much use for agriculture. They are uninhabited.

North of the Tana we find the Meranga country, a large district extending up to Mount Kenya—or, as the natives call it, Miru—which lies some 60 miles away to the north-north-east. The country, which near the Tana is level, afterwards rising gradually in a series of small hills, is very rich and fertile, and is covered with villages, beans and bananas being the chief products. Famine and drought are unknown. The Tana is said not to overflow here in the rains, although the country for some 2 or 3 miles is level with its banks. Towards the west, and up the slopes, cultivation gives place to scrub and Sodom-apple. Manga, the chief of Meranga, lives in a large village about a mile north of the Tana, and is a very friendly old man. His

village, once a great slave-trading centre, is still a great centre for the native caravans which go into northern Meranga and the Wanderobo country for ivory. There are good roads, used by the natives when driving their cattle from one grazing-ground to another.

To the south-east of Meranga, a wide grassy plain, relieved here and there by bush-covered hills, extends to the Tana. It is marshy in the rains, but was absolutely dry when I crossed it. The Rupiangasa, which traverses the centre of the plain, is a largish river. The lower ground is mostly black-cotton soil, which gives place on higher levels to red soil. There is thick bush for about a mile on each side of the Tana, with large tropical trees on the river-banks. South of the Tana the country slopes up to the Ithanga hills, most of the watercourses being dry in the dry season, but torrents during the rains. Game is here plentiful. To the south, on each side of the Thika, there is very dense thorn bush, the natives never coming here for fear of the numerous rhinoceros. At the northward turn of the Thika there are some very curious needle-like hills, each formed of a solid mass of rock. The water-parting between the Tana and Athi is ill-defined, but further east the ground slopes gradually upwards from the Tana to the group of hills commencing with Kangondi, whence again a long sloping plateau falls south-east to Kitui, beyond which a more sudden slope occurs. This plateau is broken by several watercourses (some dry), all leading to the Tiva, itself for the most part a dry river-bed which is at last lost in the sands some 100 miles down. In the dry season, all these streams merely form pools of stagnant water, which are nearly always salt and undrinkable. There are very few fresh springs in the country. The surface covering varies between bush, grass, and, finally, forest, till the river marked "Y" in the map is reached. On the south-east side of this stream (which has a dry bed with salt pools at intervals, lying in a deep, wide valley) cultivation commences and continues in patches up among the hills to the north-east, near the huts and villages of the Wakamba. Wood is scarce, and the soil is mostly red and sandy, with much quartz and mica.

THE VOYAGE OF THE "GAUSS" FROM CAPE TOWN TO KERGUELEN.

THE second number of the joint publication of the Geographical and Oceanographical Institutes at Berlin is devoted to the reports sent home from Kerguelen by the German Antarctic Expedition. These show an excellent record of solid work on the voyage of the *Gauss* from Cape Town to Kerguelen, and they contain some interesting particulars of the voyage and the vessel.

The stay at Cape Town was somewhat longer than was anticipated, as the ship was leaking considerably, and a good deal of caulking had

to be done. The ventilating arrangements had to be supplemented, and large additional purchases of crockery, glass, and laboratory apparatus had to be made to supply the loss by breakage, so that it was December 7 before the ship was ready to leave.

It is pleasant to read Prof. von Drygalski's hearty appreciation of the courtesy and kindness shown to the expedition when at Cape Town, not only by their compatriots, but by the colonial and military authorities and the scientific societies. Various changes were made in the crew before sailing, and some at least of the new recruits were not of German nationality.

Bad weather was frequent on the twenty-four days' voyage to Kerguelen, but it was found possible to take thirteen soundings, the particulars of which it is worth while to reproduce, translating the metric depths and Centigrade temperatures to our familiar units.

Lat. S.	Long. E.	Depth in fathoms	Bottom temp. Fahr.	Salinity per mille.	Deposit.
37° 41′	20° 47′	2570	34° 2	34·65	—
39° 42′	24° 49′	1676	36°·0	34·69	—
40° 0′	27° 13′	1706	36°·0	34·67	Traces of globigerina.
42° 30′	33° 45′	2780	36° 9 ?	34 51	Globigerina ooze. Much clay
43° 4′	36° 22′	1980	34°·4	34·56	" "
44° 18′	41° 48′	1342	35° 8	—	" "
44° 41′	43° 54′	995	36°·3	34·51	—
46° 18′	48° 51′	1020	35°·8	34 58	Globigerina ooze and volcanic sand.
46° 48′	50° 31′	1277	35°·4	34·56	Volcanic mud.
46° 40′	51° 23′	149	—	33·84	Coarse pieces of volcanic rock.
47° 12′	58° 8′	2674	32°·4	34·45	Globigerina ooze and volcanic material.
47° 46′	61° 23′	2512	32°·6	—	" " " "
47° 51′	66° 32′	210	35°·4	33 91	Hard ground.

These depths, though not great, are considerable, and they are important as occurring in places where almost no soundings had been made previously.

As the Crozet islands lay right in the route of the *Gauss*, it was resolved to attempt a landing on one of the group, a feat that has been rarely attempted, and still more rarely accomplished. On Christmas Day, 1901, the landing was made on Possession island, in one of the ten little bays which indent that part of the coast which stretches from south-west to north-east. Of the landing Prof. von Drygalski says—

"Outside the bay we were caught by a whirlwind rushing out from the valley leading down to the bay, and lashing the water into foam; then we came into quiet water, between far-reaching fronds of tangle (*D'Urvillia*), and landed easily and safely on a low basalt rock, amongst slumbering sea-elephants, marshalled troops of donkey penguins, white Chionæ fluttering round devoid of fear, cormorants and storm-fowls skimming swiftly over our heads—in short, we stepped

into an idyll of wild creatures, which said clearly enough that no human foot had ever before trod this solitary strand, whose inhabitants resented the intrusion, if at all, only by helpless movements. The sea-elephants raised their heads, and roared when one almost trod on them, the penguins marched forward a short distance supported by their tails, and the Chionæ ran a few steps only to settle on the nearest stone."

Time was short, and the scientific staff of the *Gauss* lost none in sentiment. Specimens of everything the island afforded, animate or inanimate, were speedily gathered, and very interesting collections they proved to be when examined at leisure by the various specialists. The island was of volcanic formation, alternate layers of tuff and basalt; but the gentler slopes and level places were thickly clothed with vegetation, especially mosses, which in parts formed morasses difficult to cross. The visit only lasted a few hours, and the voyage was resumed, Kerguelen being reached on the last day of the year.

The *Gauss* was again leaking, the sound of the water washing about under the plates of the engine-room floor having sometimes been quite distressing; but there was no real danger at any time, and the leaking was stopped while the vessel lay at the island. Instead of meeting the steamer from Sydney, and the Kerguelen Land party at Three Island harbour in Royal sound, the *Gauss* only found a German flag fluttering over a message which stated that the station was established in Observatory bay, on the site of that occupied by the British transit-of-Venus party. Hither the ship went, and found the Kerguelen party very imperfectly installed and the Australian steamer gone, leaving the coal and stores on the beach. Hard work was the lot of all on board in loading up the *Gauss* for her southward voyage, and finishing the house and observatory for the party who stayed behind to carry on simultaneous magnetic and meteorological observations. In addition to Herr Enzensperger and Dr. Luyken, the magnetician and meteorologist, with a sailor who accompanied them, the biologist of the *Gauss*, Dr. Werth, stayed at Kerguelen with a second sailor, making up the number of the land party.

The *Gauss* had on board altogether over 400 tons of coal, 158 tons of it Welsh, 209 tons New Zealand, and 40 tons of anthracite for the stores and for the land station, which it was hoped to establish in the Antarctic region. The provisions on board would supply full rations until August, 1904, while the vegetables would last much longer; so that, taking into account the fresh seal and penguin meat sure to be met with, there is no fear of want for three years at least. All the equipment and the ship herself were absolutely satisfactory. The sledge-dogs taken on board at Kerguelen were in the best condition, and greatly pleased the leader of the expedition. With the highest hopes and the greatest confidence in themselves and their plans, the expedition left Kerguelen on January 31, 1902, straight for the

unknown. The plan included a possible landing on Heard island, and then a straight run for the position of Wilkes' Termination Land, whence the edge of the ice was to be followed westward, and the first opportunity taken to get south. The place of the wintering station Dr. v. Drygalski promises to tell when he comes back. It is interesting to note that the *Gauss* is the first ship to attempt to follow the alleged track of Morrell, whose vague narrative showed that he claimed to have passed from near Enderby Land far southwards, emerging in Weddell sea. The Kerguelen station is to remain in activity until March 1, 1903, from which date the members will be ready to embark at short notice when sent for from Australia.

The dispatches which made up this most interesting report were brought from Kerguelen on April 2 by the German steamer *Essen*, which called specially on a voyage from the Cape to Australia.

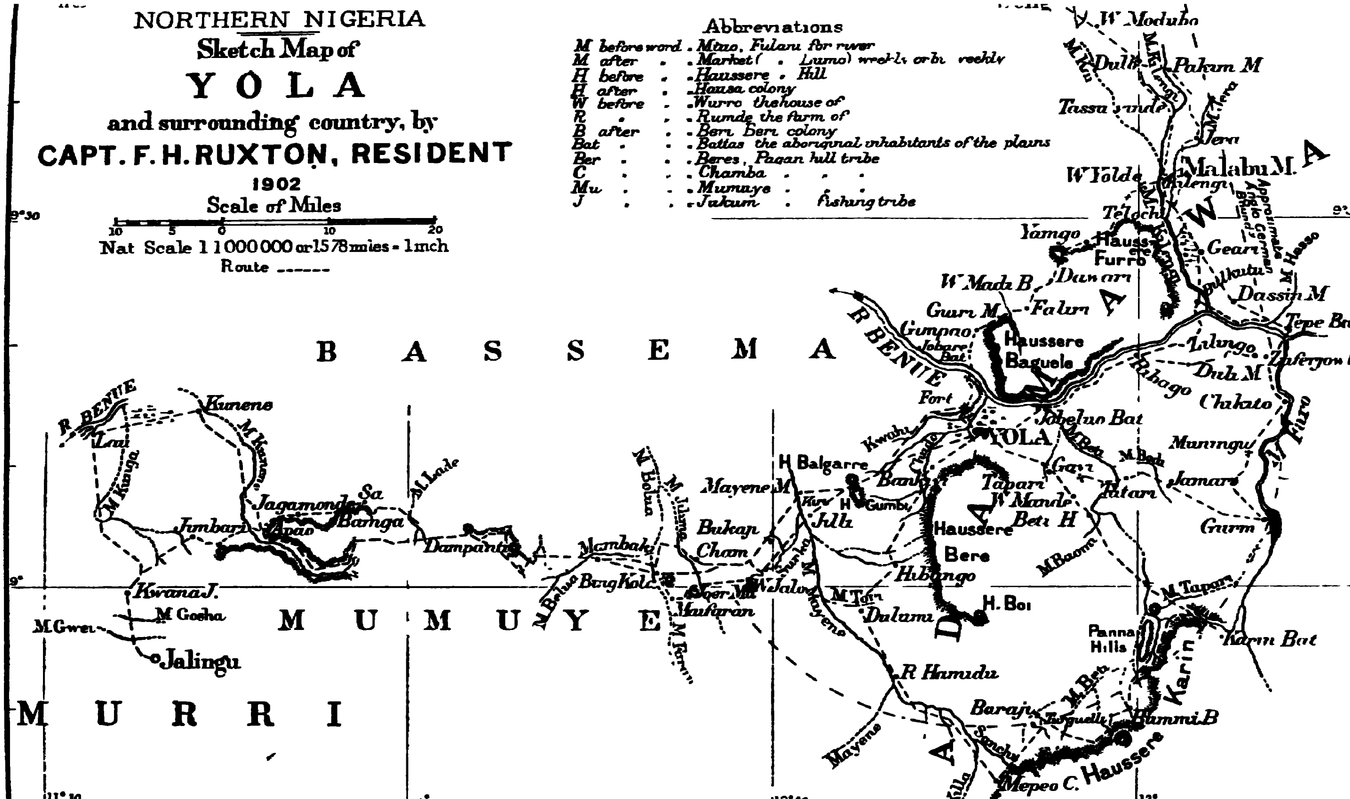
The greatest credit is due to the authorities in Berlin for so promptly publishing these full reports, illustrated by photographs and maps, for it is surely a record in scientific publication that reports written in Kerguelen in April should be published in Berlin in August.

YOLA.

By Captain F. H. RUXTON

The accompanying sketch shows the country situated on the upper Benue, now designated as the province of Yola. This part of Northern Nigeria fell under our sphere of influence by the Anglo-German Agreement of 1893, and was effectively occupied in September of last year. The routes were roughly sketched during the dry season of 1901–1902

Barth was the first to enter this country, in 1851, coming from Kukawa, the then capital of Bornu; he was only allowed to remain a week, being forced to return by Mohammed Lowel, a half-brother of the present Emir. Since then many travellers have given descriptions of their travels through Adamawa, notably Dr. Passarge. All, however, were compelled to follow the main trade roads, and never penetrated into these mountain fastnesses where the pagan aborigines still hold their own against the Mohammedan Fulani raiders. The ethnology of these various peoples—Mumuyes, Battas, Beres, etc.—untouched by outside influences, would be of the greatest interest, and would well repay study on the part of competent observers. The physical features of the country may be briefly described as consisting of the basin of the Benue, with hills running in more or less parallel ranges to the course of the river. These ranges increase in height as they recede from the river until, in the south, they reach the dignity of mountains and form the watershed of the Benue and Atlantic streams. These hills, granite in composition, are mostly barren and devoid of verdure; for though their summits and slopes are often inhabited by wild pagan tribes, their



NORTHERN NIGERIA
Sketch Map of
YOLA
and surrounding country, by
CAPT. F. H. RUXTON, RESIDENT
1902
Scale of Miles
10 5 0 10 20
Nat Scale 1 1000000 or 15.78 miles = 1 inch
Route ------
Abbreviations
M before word . Mayo, Fulani for river
M after . . Market (. Lumo) weekly or bi weekly
H before . . Haussere . Hill
H after . . Hausa colony
W before . . Wurro the house of
R . . . Rumde the farm of
B after . . Beri Beri colony
Bat . . . Battas the aboriginal inhabitants of the plains
Ber . . . Beres, Pagan hill tribe
C . . . Chamba
Mu . . . Mumuye
J . . . Jukum . fishing tribe
B A S S E M A
M U M U Y E
M U R R I
R BENUE
YOLA
Fort
Haussere Baguele
Haussere Bere
H. Boi
Kunene
Jimbari
Jagamonde
Sa
Banga
Dampanti
Kwana J.
M Gosha
M Gwei
Jalingu
H Balgarre
Mayene M
Bukapi
Cham
Jili
Dulami
R Hamidu
Baraji
Mepeo C.
Haussere
Karin
Karin Bat
Panna Hills
Malabu M.
W Yolde
Yamgo
Furro
W Madi B
Falun
Guri M
Lilungo
Dub M
Chakato
Tepe Bat
Dassin M
Pakam M
W Modubo
Tassa
Jera
Gurin
Jamare
Munngu
Tapari
Beti H
Hibango
Gumbi
Approximate Anglo German Boundary
9°30
9°
11°30
12°30
13°

cultivation is mostly done in the small secluded valleys that abound in these mountain masses. The flat-topped hill, so characteristic of Africa, and especially of the valley of the Niger, is hardly seen, though single sugar-loaf cones are often met with to the north of the river in the neighbourhood of Song.

The alluvial valleys of the Benue and its large tributary, the Faro, consist of rich low-lying lands, covered with a tall rank grass, and subject to yearly inundations of great extent in the rainy season. The general level of the country is low, the town of Yola, 750 miles up-river, being only 656 feet above sea-level according to Flegel's observations. In general appearance the country may be said to consist of scrubby veldt, and to much resemble parts of Rhodesia. The rainy season sets in at the beginning of April, and continues to the end of October, the rivers reaching their highest level about September 1. Though the Benue is then of great depth, navigation is much obstructed by sand-bars, so that only steamers drawing 8 feet of water can reach Yola, and then only during a short period of the rainy season. The smallest stern-wheelers can get up to Yola during five months in the year; but owing to the rocks in the river, the reaches above the town can only be navigated for a still shorter period. The Faro is also available for stern-wheelers, but to a distance not ascertained; its current is much more rapid than that of the main river, and is probably as great as 5 miles an hour. At the end of the rainy season the country becomes much parched, none of the streams being perennial except the Benue, and even that river is fordable in many places, and canoe-navigation as far as Lau is only carried on with difficulty. Water, however, can generally be procured in the bed of the dry water-courses by scooping small holes in the sand.

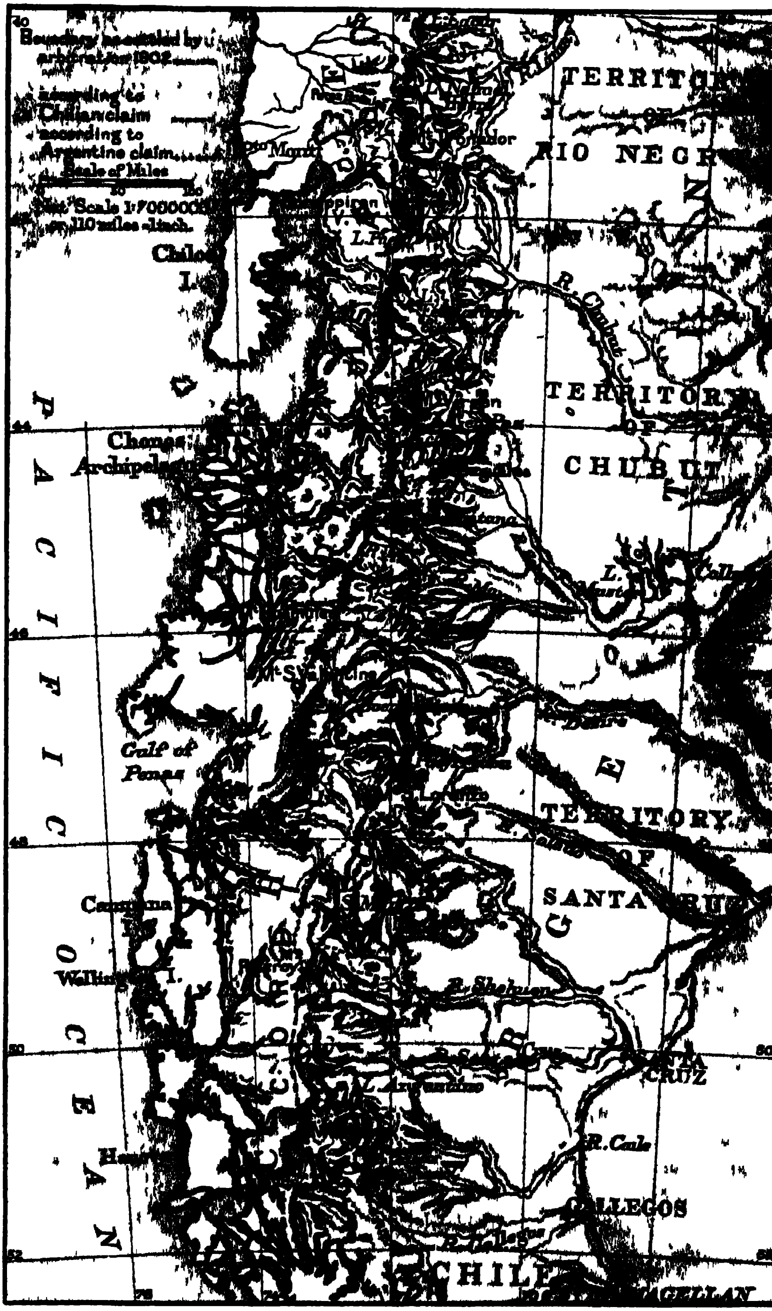
Yola was the capital of the Fulani state of Adamawa, and formed part of the Sokoto empire. Founded about seventy years ago by Mallem Madebo, after he had consolidated his power, the town is as badly situated from every point of view as it is possible to conceive. In the rains the town is almost completely surrounded by impassable swamps and large flooded areas; in the dry season water is scarce and of the worst description. Except at high water, canoes cannot approach nearer than 5 miles from the town, and it is most inconveniently situated for the land trade. Yola covers a large area, and consists of round mud huts with well-thatched conical roofs, standing in compounds surrounded by mat enclosures. These compounds are often of large extent, inside of which guinea corn is grown. Looking down from the surrounding heights, the site of the town is marked by an oval of foliage, no buildings being seen. Only the Emir and a few of the big men have superior dwellings—mud houses built in the Arab style, and the compounds surrounded by high mud walls. The city is divided into two distinct portions, the larger to the west inhabited by the ruling

Fulanis and their numerous slaves, the smaller by the Hausa traders and other settlers. The town area is not surrounded by walls or any other means of defence; a gateway even does not exist. The Fulanis, no doubt, relied on the open surrounding country, where their cavalry could manœuvre, for their means of defence. Next to Yola the two most important towns in the province are Song and Malabu, each ruled by a vassal of the Emir of Yola. Scattered over the country are colonies of Beri-Beris, immigrants from Bornu during the time of Rabah's wars, and of Hausas. In the hands of the latter lies the trade of the country; irrigation is carried on by them to a small extent at Meyene, Beti, and Dassin, wheat and onions being the principal articles grown. The ethnography of the district is of too varied a character to be touched on in the space at disposal; suffice it to say that since the Fulah conquest a century ago, slave-raiding has denuded many fertile districts of their indigenous inhabitants, but now there is every reason to hope that the advent of settled government may engender that feeling of security which alone can restore the former prosperity of this fertile land.

THE CHILE-ARGENTINE ARBITRATION.

Whilst all the civilized world has been occupied in watching the progress of events in South Africa, very little interest has been shown in political developments in South America. And yet it may be doubted whether, from the purely financial point of view, the attainment of a peaceful issue to the recent boundary dispute between Chile and Argentina is not quite as important to England as the assurance of peace in South Africa. The amount of British money expended over the war cannot differ largely from the amount of capital invested in South American securities generally; in either case, that amount totals up to something over two hundred million sterling. But the two hundred million which the tax-payer has contributed towards the South African war expenses has so largely returned to the tax-payer's country (if not to his pockets), that it is very doubtful whether one-tenth of that sum has really benefited foreign countries. Contractors and ship-owners have grown rich upon it, and in the great majority of cases these contractors and ship-owning firms are British. Cape Town and Durban, aided by the wealth which has been poured into them lately, should expand from the status of second-class provincial towns into centres of civilized development more nearly approaching to that which has already been attained by Buenos Aires in South America; and their rise, together with the general advance of all the chief centres of administration in South Africa, will surely reflect again on British prosperity, and prove an indirect, if not a direct, gain to British finance. In the long run, the cost of the war in South Africa will very

NEW BOUNDARY BETWEEN CHILE AND THE ARGENTINE REPUBLIC



possibly prove to be a good investment of capital. But what would be the result of a war in South America? Most of the British capital already invested would probably be safe, although some of it would certainly be imperilled; but South American investments generally would sink indefinitely in value; there would be collapses on the Stock Exchange, and undoubtedly the interest of the vast sums sunk in South American railways and other public works would be wanting so long as the war lasted, if not for ever. In short, a war between Chile and Argentina, which would have all the bitterness of a civil war, and would be fought on the lines of a European campaign out to the end by two countries possessing numerous and well-equipped armies backed by powerful fleets, whose strength in armour and armament has been carefully balanced for years, would not only spell ruin and disaster to both the countries concerned (no matter which of them had the best of it), but would prove a most costly complication for England. King Edward's award, therefore, which closes a dangerous episode of international dispute of more than half a century's duration; which establishes a happy prospect of peace, and points to a period of internal development which will vastly strengthen the financial position of both countries, is an immense gain to this country, and is of none the less value because it has cost the country nothing at all. The expenses connected with arbitration are equally shared by the two republics concerned.

The map illustrates the nature of the award. It shows a dividing-line between the two claims which assigns the more northern districts of the disputed area to Argentina, and the southern districts to Chile. It would appear from the map that Chile has gained something in area, but in a mountainous region such as the Southern Andes, where by far the greater part of the country consists of unprofitable mountain slopes, the actual extent of the award on either side has no significance. The Welsh colony of "16 Octubre," together with the contiguous valleys of Nuevo and Cholila, which now definitely become Argentine territory, are valleys of great promise for pastoral and agricultural purposes, and will undoubtedly prove a most valuable addition to those magnificent fields of pasture land which already make Argentina the finest meat-producing country in the world. In amongst the rugged hills, clothed with beech forest from the snow-line to the flats, there is many another comparatively narrow band of grass country which, in the hands of a capable colonist, will develop a rich pasturage, just as the pampas-grass covered flats of the provinces have turned into broad acres of almost inconceivably rich herbage in response to the demands of the cattle turned on to them. It yet remains to be seen what will *not* grow in those Southern Andine valleys under the influence of the warm sun and soft mists of the Pacific. It is a great mistake to suppose that the Southern Andes will not repay the costs of arbitration many hundred-fold. Chile gains a large area of forest country, and a good many

square miles of wool-producing upland. Southern Patagonia is already making an impression on the wool market, and there is nothing now to hinder its growth. The want of title to the land has been the great difficulty with sheep farmers hitherto, as they have been afraid to sink capital on their holdings so long as their tenure was insecure. There is at least one town in this southern province of Chile of which the world will hear more in future. Punta Arenas is already the port of call of nearly all steamers rounding the South American continent, and is, in municipal enterprise, well ahead of most South African ports. Punta Arenas, with a wool-developing Chilean province behind it, will become an important item in the world's commercial geography.

The following are the recommendations of the Arbitration Tribunal, recommendations followed by King Edward VII. in giving his decision :—

There are four distinct subjects upon which we are called upon to make recommendations, viz.—

1. The region of the San Francisco pass in lat. 26° 50′ S., approximately.

2. The Lake Lascar basin, in lat. 40° 10′ S., approximately.

3. The region extending from the Perez Rosales pass, in lat. 41° S., approximately, to the vicinity of Lake Viedma.

4. The region of Last Hope inlet to the 52nd parallel of south latitude.

Our recommendations upon these four subjects are as follows: *—

The San Francisco Pass.—The initial point of the boundary shall be the pillar already erected on the San Francisco pass. From that pillar the boundary shall follow the water-parting which conducts it to the highest peak of the mountain mass, called Tres Cruces, in lat. 27° 0′ 45″ S., long. 68° 49′ 5″ W.

Lake Lacar.—From the point of bifurcation of the two lines claimed as boundaries respectively by Chile and Argentina, in lat. 40° 2′ 0″ S., long 71° 40′ 36″ W., the boundary shall follow the local water-parting southwards by Cerro Perihueico to its southern termination in the valley of the river Huahum. From that point it shall cross the river in long. 71° 40′ 36″ W., and thenceforward shall follow the water-parting, leaving all the basin of the Huahum above that point, including Lake Lacar, to Argentina, and all below it to Chile, until it joins the boundary which has already been determined between the two republics.

Perez Rosales Pass to Lake Viedma.—The southern termination of the boundary already agreed upon between the two republics north of Lake Nahuel Huapi is the Perez Rosales pass connecting Lago de Todos los Santos with Laguna Fria. Here a pillar has been erected. From this pillar the boundary shall continue to follow the water-parting southward to the highest peak of Mount Tronador. Thence it shall continue to follow the water-parting which separates the basins of the rivers Blanco and Leones (or Leon) on the Pacific side from the upper basin of the Manso and its tributary lakes above a point in long. 71° 52′ W., where the general direction of the river course changes from north-west to south-west. Crossing the river at that point, it shall continue to follow the water-parting dividing the basins of the Manso above the bend, and of the Puelo above Lago Inferior, from the basins of the lower courses of those rivers, until it touches a point midway betwe n Lakes Puelo and Inferior, where it shall cross the river

* All co-ordinate values expressed in terms of latitude and longitude are approximate only, and refer to the maps attached to this report. Altitudes quoted in the text are in metres. Where the boundary follows a river, the "thalweg" determines the line.

Puelo. Thence it shall ascend to, and follow, the water-parting of the high snow-covered mountain mass dividing the basins of the Puelo above Lago Inferior, and of the Fetaleufu above a point in long. 71° 48′ W. from the lower basins of the same rivers. Crossing the Fetaleufu river at this point, it shall follow the lofty water-parting separating the upper basins of the Fetaleufu and of the Palena (or Carrenleufu or Corcovado) above a point in long. 71° 47′ W., from the lower basins of the same rivers. This water-parting belongs to the Cordillera, in which are situated Cerro Conico and Cerro Serrucho, and crosses the Cordon de las Tobas. Crossing the Palena at this point, opposite the junction of the river Encuentro, it shall then follow the Encuentro along the course of its western branch to its source on the western slopes of Cerro Virgen. Ascending to that peak, it shall then follow the local water-parting southwards to the northern shore of Lago General Paz at a point where the lake narrows in long. 71° 41′ 30″ W. The boundary shall then cross the lake by the shortest line, and from the point where it touches the southern shore it shall follow the local water-parting southwards, which conducts it to the summit of the high mountain mass indicated by Cerro Botella Oeste (1890 metres), and from that peak shall descend to the Rio Pico by the shortest local water-parting. Crossing that river at the foot of the water-parting, in long. 71° 49′ W., it shall ascend again in a direction approximately south, and continue to follow the high mountain water-parting separating the upper basin of the Rio Pico above the crossing from the lower basin of the same river, and from the entire basin of the Rio Frias, until it effects a junction with the continental water-parting about the position of Loma Baguales, in lat. 44° 22′ S., long. 71° 21′ W. From this point it shall continue to follow the water-parting dividing the basins of the Frias and Aisen rivers from that of the Senguerr until it reaches a point in lat. 45° 44′ S., long. 71° 50′ W., called Cerro de la Galera in the map, which marks the head of an affluent flowing south-eastwards into the main stream of the river Simpson or southern branch of the Aisen. It shall descend this affluent to its junction with the main stream, and from this junction shall follow the main stream upwards to its source under the mountain called Cerro Rojo (1790 metres) in the map. From the peak Cerro Rojo it shall pass by the local water-parting to the highest summit of the Cerro Ap Ywan (2310 metres). From Cerro Ap Ywan it shall follow the local water-parting determined by the promontory which juts southwards into Lago Buenos Aires in long. 71° 46′ W. From the southern extremity of this headland the boundary shall pass in a straight line to the mouth of the largest channel of the river Jeinemeni, and thenceforward follow that river to a point in long. 71° 59′ W., which marks the foot of the water-parting between its two affluents, the Zaballos and the Quisoco. From this point it shall follow this water-parting to the summit of the high Cordon Nevada, and shall continue along the water-parting of that elevated cordon southwards, and thence follow the water-parting between the basins of the Tamango (or Chacabuco) and of the Gio, and ascend to the summit of a mountain known locally as Cerro Principio, in the Cordon Quebrado. From this peak it shall follow the water-parting which conducts it to the southern extremity of the headland jutting southward into Lago Pueyrredon (or Cochrane), in long. 72° 1′ W. From this headland it shall cross the lake, passing direct to a point on the summit of the hill, in lat. 47° 20′ S., long. 72° 4′ W., commanding the southern shore of the lake. From this summit it shall follow the lofty snow-covered water-parting, which conducts it to the highest peak of Mount San Lorenzo (or Cochrane, 3360 metres). From Mount San Lorenzo it shall pass southward along the elevated water-parting dividing the basin of the river Salto on the west from that of the river San Lorenzo on the east, to the highest peak of the Cerro Tres Hermanos. From this peak it shall follow the water-parting between the basin of the upper Mayer on the east, above the point where that river changes its course from north-west

to south-west, in lat. 48° 12′ S., and the basins of the Coligue or Bravo river and of the Lower Mayer, below the point already specified, on the west, striking the north-eastern arm of Lago San Martin at the mouth of the Mayer river. From this point it shall follow the medium line of the lake southwards as far as a point opposite the spur which terminates on the southern shore of the lake in long. 72° 47′ W., whence the boundary shall be drawn to the foot of this spur, and ascend the local water-parting to Mount Fitzroy, and thence to the continental water-parting to the north-west of Lago Viedma. Here the boundary is already determined between the two republics.

Region of Last Hope Inlet.—From the point of divergence of the two boundaries claimed by Chile and Argentina respectively in lat. 50° 50′ S., the boundary shall follow the high crests of the Sierra Baguales to the southern spur which leads it to the sources of the Zanja Honda stream. Thence it shall follow that stream until it reaches existing settlements. From this point it shall be carried southwards, having regard, as far as possible, to existing claims, crossing the river Vizcachas and ascending to the northern peak of Mount Cazador (948 metres). It shall then follow the crest-line of the Cerro Cazador southwards, and the southern spur which touches the Guillermo stream in long. 72° 17′ 30″ W. Crossing this stream, it shall ascend the spur which conducts it to the point marked 650 metres on the map. This point is on the Continental water-parting, which the boundary shall follow to its junction with the 52nd parallel of south latitude.

GEOGRAPHICAL DISTRIBUTION OF PLANT-GROUPS IN IRELAND.*

By R. LLOYD PRAEGER.

For the purpose of expressing the horizontal range of flowering plants in Great Britain, H. C. Watson † has employed eight "Types of Distribution," which he has named and defined as follows:—

1. British type—species widely spread through S.M.N. Britain.
2. English type—species chiefly seen in S. or S.M. Britain.
3. Scottish type—species chiefly seen in N. or N.M. Britain.
   Intermediate type—species chiefly seen in Mid-Britain.
4. Highland type—species chiefly seen about the mountains.
5. Germanic type—species chiefly seen in East England.
6. Atlantic type—species chiefly seen in West England.
   Local species, restricted to single or few provinces.

Watson is careful to state that in the use of the names for these types he does not make any suggestion regarding the centre of dispersal or route of migration of the plant-groups which they represent; he uses them simply to express facts of present distribution in Great Britain; Ireland does not come within the scope of his inquiries. I propose, in the first place, to review the distribution in Ireland of Watson's types, and from that to pass on to the consideration of natural Types of Distribution in Ireland as revealed by a study of the flora of that country.

The most convenient way of expressing the facts to be dealt with is by means of a series of statistical maps, constructed according to a uniform plan, in five depths of shading. The units of area employed are the forty county-divisions of

* Abstract of papers recently read before the Royal Irish Academy and the British Association (Belfast Meeting). The illustrations are taken (by permission of the Council) from the *Proceedings* of the R.I. Academy, vol. xxiv., section B, No. 1, where a full discussion of the subject will be found.

† *Cybele Britannica*, i. 43 (1847), iv. 409 (1859); and *Compendium of the Cybele Britannica*, 23 (1868–70).

"Irish Topographical Botany," and the standard used as a list of the Irish flora and its distribution, is taken from the same work, posted up to date. For the construction of the maps, the distribution in the forty divisions of the component species of each group has been tabulated. From the totals thus obtained for the county-divisions, giving the number of plants of the type present in each, the lowest and highest figures are taken, and the intervening space divided into five equal portions. The forty totals are grouped according to these five portions, and the map shaded accordingly in the order:—

(1) white, (2), (3), (4), (5) black.

1. British Type: "Species widely spread through S.M.N. Britain."—To this type belongs the mass of our common plants. From the definition of the type we should expect to find plants of this group largely represented and widely spread in Ireland, and this expectation is verified.

Of the distribution of the 377 typical British type plants in Ireland, I have made a somewhat minute analysis, to discover if the varying conditions of soil and climate produce any increase or diminution in their numbers in north or south, east or west. There is no indication of the kind.

2. English Type: "Species chiefly seen in S. or S.M. Britain."—These are the southern plants of Great Britain, having their headquarters in the south of England. They are largely lowland species favouring light soils.

Of plants of pure English type, 135 are included, according to our standard list, in the Irish flora. But of these, no less than 44, or 33 per cent., are reckoned in Ireland as possibly, probably, or certainly introduced. Here, in fact, we have come upon the home of the large section of our vegetation which owes its presence in the country to the operations of man—the weeds of cultivation, and light-soil plants. Leaving these out of account, the distribution in Ireland of "English" plants works out as in Fig. 1.

This map shows clearly how the English type plants reach their maximum along the east coast in Dublin, Wicklow, and Wexford, as we should expect them to do from considerations of position, soil, and climate. Their great abundance in Clare is a remarkable point, to which we shall presently return. For the rest, excepting their frequency in Antrim, they decrease from S.E. to N.W.

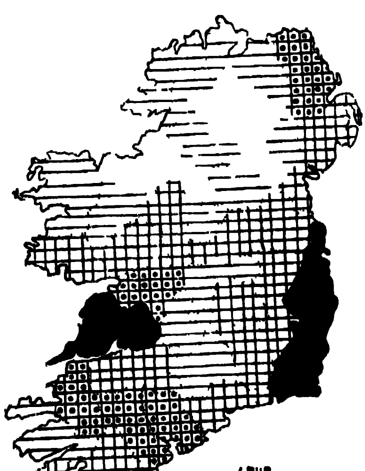


FIG. 1.—DISTRIBUTION OF "ENGLISH" PLANTS.

3. Scottish Type: "Species chiefly seen in N. or N.M. Britain."—This type is the opposite of the last. With headquarters well up in Scotland, the species range southward in diminishing numbers. They are the northern plants of Britain. This is a purely native group; not one of them is under any suspicion of introduction. Most of them are plants of thoroughly wild ground—hills, heaths, glens, lakes, and bogs.

Constructing our map, we get Fig. 2.

The result is striking. The Scottish type plants are concentrated in the north, as we should expect. Thence they range down the coast on either side:

but while on the east they greatly diminish south of Co. Down, on the west coast they maintain their sway as far south as Clare, or even North Kerry.

FIG. 2.—DISTRIBUTION OF "SCOTTISH" PLANTS

4. HIGHLAND TYPE: "Species chiefly seen about the mountains."—As H. C. Watson points out, the more characteristic members of this group might be better called Arctic type, as they consist of high northern species, brought into our latitudes by the elevation of the land into mountains. This group occupies the northern end of the series of four latitudinal types—English, Intermediate (a small and indefinite group), Scottish, Highland. Its headquarters are on the high Scotch mountains and in the extreme north of that country. With the vertical distribution of the species the present paper is not concerned; but some interesting points become apparent from the mapping of their horizontal range (Fig. 3).

Being essentially a mountain group, it is desirable to contrast their distribution with that of high land in Ireland—say of over 2000 feet elevation (Fig. 1).

In area of high ground, whether the 1000-foot or 2000-foot contour line be

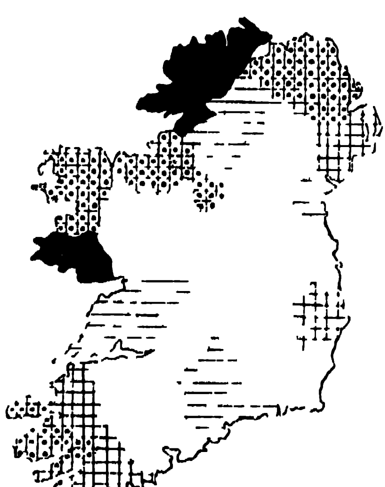


FIG. 3.—DISTRIBUTION OF "HIGHLAND" PLANTS

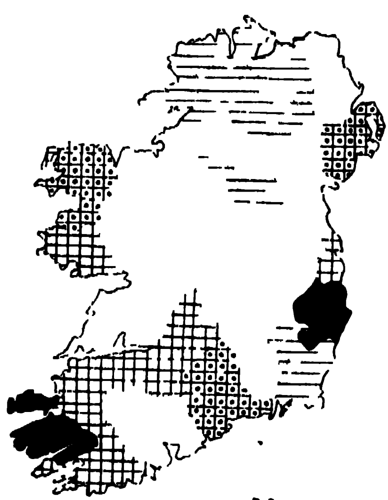


FIG. 4.—DISTRIBUTION OF LAND OVER 2000 FEET.

taken, Wicklow and South Kerry far outstrip any other portion of the country: yet both fall below the maximum of alpine plants, which is carried off by West Galway, and the two divisions of Donegal. The distribution of highland ground

is, in fact, no criterion of the distribution of the highland flora. The amount of high ground in western Ireland (Kerry to Donegal inclusive) is about the same as that in eastern Ireland; but the collective highland flora of the western half is double that of the eastern. If we want to get an analogue of the distribution of the alpine flora we turn to the Scottish type map, and at once see many points of resemblance.

Those "Highland" plants which occur in the east, as on the Mourne and Wicklow mountain ranges, are usually truly alpine in habitat; in the west a change of conditions is clearly shown by the frequent descent of alpines to sea-level, and by the ascent of maritime plants to high elevations (such as *Cochlearia officinalis*, *Silene maritima*, *Armeria maritima*, *Plantago maritima*) which are absent on the eastern mountains.

5. GERMANIC TYPE: "Plants chiefly seen in East England."—This is a special group of English type plants, segregated and separately classed on account of their masked aggregation towards the south-east. As Watson points out, the Cretaceous deposits lie almost exclusively in the eastern and south-eastern provinces of England, so that the "chalk plants" fall within this type.

Being the furthest removed from Ireland as regards not only actual distance, but soil and climate, it is to be expected that this should be the type least numerously represented in this country, and such is the case. Out of one hundred and two "Germanic" plants in England, only thirteen are enumerated in the Irish flora, and four of these cannot be reckoned in the certainly indigenous list. The distribution of the native members of the group works out as in Fig. 5.

This result is significant, even though, when dealing with the distribution of so small a number of plants, it is unwise to lay too great emphasis on present results. The fact is that, as a group, the Germanic plants have no place in the Irish flora; such stragglers as have found their way here have a distinctly *limestone* range.

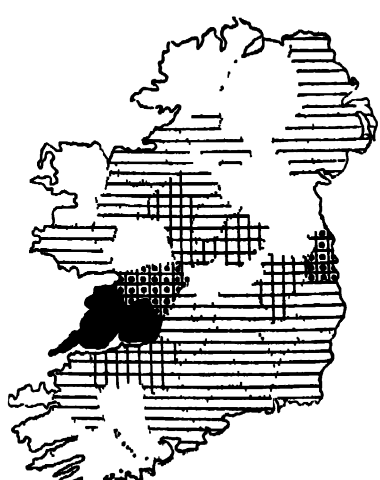


FIG. 5.—DISTRIBUTION OF "GERMANIC" PLANTS.

FIG. 6.—DISTRIBUTION OF "ATLANTIC" PLANTS.

6. ATLANTIC TYPE: "Species chiefly seen in West England."—This group has its headquarters in the south-west of England, and is in this way related to the

"Hibernian" and "Lusitanian" groups of Ireland, since it includes the remnants of the old southern flora that flourished on the lost south-western shore-line of the British Isles.

Our map works out very prettily. The group is seen to be essentially coastal—partly on account of the plentiful sprinkling of maritime species, partly because the remainder are largely plants of the rough country which often accompanies the older rocks; such country as is found in the home of the group in Devon, Cornwall, and Wales, and in Ireland round a great portion of the seaboard. The group also shows an increase southward, and attains its full luxuriance round the shores of the southern half of Ireland.

Before proceeding to briefly sum up the features brought out by the foregoing eries of maps, it will be well to consider one important factor in plant-distribution. Apart from climate, the most potent influence affecting the flora is undoubtedly soil, and it is the presence or absence of lime in soils that most affects the vegetation which they support. Ireland consists, roughly speaking, of a great plain of Carboniferous limestone occupying the centre, with more elevated and broken ground formed of non-calcareous rocks around the margin. The actual distribution of limestone is shown in black on the following map (Fig. 7). Let us compare this with the distribution of lime-loving and lime-avoiding plants.

FIG. 7.—ACTUAL DISTRIBUTION OF CARBONIFEROUS LIMESTONE.

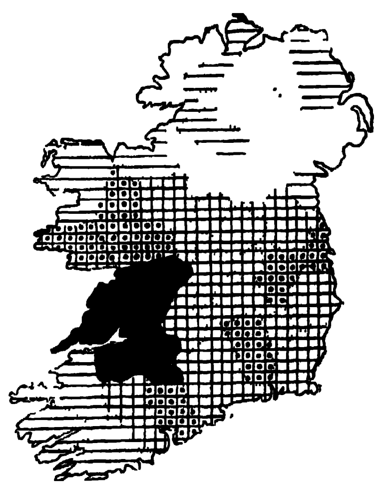


FIG. 8—DISTRIBUTION OF CALCICOLE PLANTS.

The result is somewhat unexpected. The calcicole group has its headquarters, not in the Limestone Plain, but in the west, reaching its maximum in Clare, South-East Galway, and Limerick. The reason for the great development of the calcicole group in the west is not far to seek; it lies in the occurrence of bare limestone pavements in the Burren area, in Limerick, and around the great lakes of Corrib and Mask. It is the presence of live limestone rock over large areas that produces the calcicole flora in its full development. The tough limestone drift which covers the rock over the greater portion of the Central Plain and eastern counties may, as a matter of fact, have all the lime washed out of its surface layers, and yield a non-calcareous soil

To turn to the calcifuge group. The plants which show a preference for a non-calcareous soil are more numerous than those which prefer lime. It will be noted (Fig. 9) that calcifuge plants are more abundantly spread than calcicole. The reason is clearly to be seen in the fact that non-calcareous soils are to be found in limestone areas, both on account of the washing-out process referred to, and by reason of accumulation of vegetable matter, in woods, and much more in bogs, which are largely developed in the Irish limestone districts. On the other hand, no natural process is at work in this country producing a calcareous soil in districts devoid of limestone, except on coastal sands, where shelly accumulations may have a distinct effect on the flora.

FIG 9.—DISTRIBUTION OF CALCIFUGE PLANTS.

Comparing generally the series of maps showing the range in Ireland of the "types" of Great Britain, it will be seen that we have really three topographical groups to deal with—

(1) *English and Germanic*, the latter a peculiar and intensified section of the former. A southern group, often light-soil and often calcicole in their proclivities. The Germanic group represent the xerophile and thermophile element in the flora of England, and is congregated where a comparatively continental climate produces hot and dry summers. In Ireland these groups are concentrated along the east and south-east coasts, where position, soil, and climate apparently account for their predominance; and in the Clare district, where the warm limestone pavements coupled with a mild climate probably form the attraction.

(2) *Scottish and Highland*.—These are the northern plants, the latter an intensified group of the former. In Ireland they are concentrated in the north, spreading somewhat abundantly down the western coast, much more sparsely along the eastern. It should be noted that the distribution in England and Wales of these plants offers many points of resemblance to their Irish range, though the species extend somewhat further southward in the larger island. As in Ireland, the group spreads far down the west coast of England, much less so down the eastern, so that, on a rough examination, South Wales appears to contain as many "Scottish" plants as the Trent province. Physical conditions will suggest themselves in explanation of this in a manner not applicable to Ireland, where the problem is more difficult of solution. A line drawn north-eastward from the Bristol channel to the Wash will cut off, on the northward, most of these plants; and this line would appear to correspond well with one in Ireland drawn from the Shannon mouth to Dundalk bay.

(3) *Atlantic*.—In England south-western and including a considerable number of maritime plants. This is the hygrophile element of the English flora, composed of plants which prefer the equable temperature and abundant moisture that pertain to an insular climate. In Ireland the group is rather southern, distributed in fair proportion round the southern half of the littoral, but many of the species occur round the greater part of the Irish coast.

Glancing at the maps showing the distribution of calcicole and calcifuge species, it will be seen that, while the range of the "Scottish," "Highland," and "Atlantic" plants corresponds broadly with that of the calcifuge flora, the distribution of "English" and "Germanic" species offers many points of resemblance to that of the calcicole group, which facts we should expect to be apparent when we consider the petrological conditions prevailing in the homes of Watson's various "types."

So far as I can gather, without an elaborate study of the distribution of the flora of Great Britain as known at present (which would be outside the scope of the present paper), there is a greater overlap in northern and southern forms in England than is the case with Ireland. If we construct isophytic lines to represent the limit of the main body of the "Scottish" and "English" floras respectively in Great Britain and in Ireland, they run somewhat like this:—

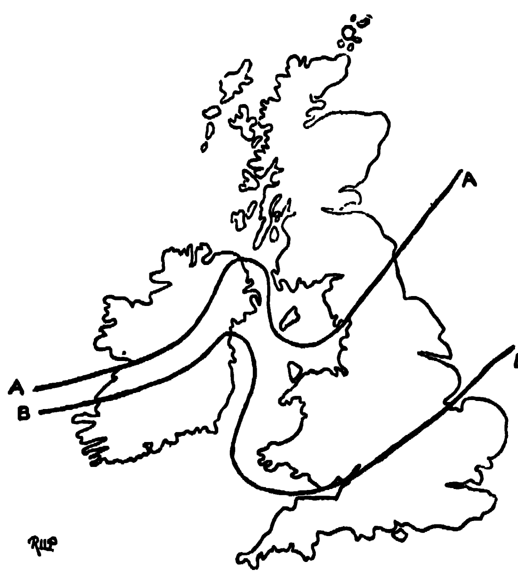


FIG. 10—ISOPHYTIC LINES IN THE BRITISH FLORA AA, NORTHERN LIMIT OF THE "ENGLISH" FLORA; BB, SOUTHERN LIMIT OF THE "SCOTTISH" FLORA.

To come now to the second portion of my subject—the question of natural geographic plant-groups in the Irish flora. Following on Watson's lines, an essay was made to group the native species according to their present horizontal range, and without reference (in the first instance) to the environmental or other cause of such distribution. For this purpose, a set of maps was employed representing the whole Irish flora, each map showing, by means of a uniform wash of colour, the range of one species, the data used being those given in "Irish Topographical Botany," brought up to date on these maps. Divisions in which any plant was considered as probably or certainly introduced were left uncoloured. The set of over eleven hundred maps was then sorted by eye according to the distribution of the colour on each. In this way, by making the process as mechanical as possible, I hoped to determine the natural grouping of the plants, and to eliminate theoretical considerations. The groups thus obtained were then critically examined, and the claim of each member to belong to it considered. This involved questions of

relative frequency throughout the range, and considerations relating to possible introduction in certain divisions.

The grouping of the maps established in the first place two classes: (A) plants which show no aggregation in any portion of the country; and (B) plants which show an aggregation or diminution in some portion of the country. Class A corresponds with Watson's British type, and consists mainly, but by no means exclusively, of the same species. It need not detain us at present, and we turn to a consideration of the distribution of those plants which show an aggregation in some part of the country.

As regards Class B, it is to be remembered that, as compared with Great Britain, Ireland is small, with a more restricted range both in latitude and in longitude, and in altitude as well. It is also of more even shape, being roughly elliptical in outline, and possesses less variety of surface and climate. It is not surprising, therefore, that the flora of its various portions displays a reduced diversity; in other words, that the number of species of strongly marked local range is not large. Nevertheless, some definite features of distribution came out clearly as the maps were studied. The first strong character displayed is a tendency towards a central or marginal distribution, a peculiarity not found to any marked degree in the flora of Great Britain, and resulting from the physical features of the country. The non-calcareous rocks and the mountain groups lie around the edge of the country, and here is concentrated the flora pertaining to such conditions; while the low-lying limestone plain, with its numerous bogs, marshes, and lakes, is the headquarters of a different set of species. By referring a plant to the "Central" type of distribution, then, we signify that it is found chiefly in the Central Plain. While plants of this type often extend to the margin of the island in the east and west, they show a marked restriction of range towards the north and south.

The Central type of distribution may be defined as being limited by a line joining the Shannon mouth with Waterford on the south, and a line joining Sligo bay with Dundalk bay on the north, while in its most characteristic form it does not touch either the eastern or western margin of the island. The circle on Fig. 11 approximately defines its ideal boundary.

The Marginal type, which is, generally speaking, the converse of this, hardly requires definition, as its name is sufficiently descriptive. The plants which belong to it are characterized by a tolerably even though frequently discontinuous range through those divisions which lie around the margin of the island, and by an avoiding of the Limestone plain. The negative character of avoidance of the Central plain is the most striking feature of this type of distribution; and the ring which marks the range of the constituent species frequently thickens considerably in the north and south, where the coast-line lies far from the edge of the plain.

A number of the rarer and more interesting plants of Ireland are more or less marginal in distribution (being rare in the Central Plain), but are restricted to limited areas; while many others show a general increase towards the north, south, east, or west of the island. As regards these, the strongest phytological boundary which developed itself is one which corresponds with the curves evolved from a consideration of the range in Ireland of the northern and southern plants of Great Britain (see Fig. 10); and this boundary can be best localized by drawing a line from Galway bay on the west to Dundalk bay on the east. The need of a dividing line between eastern and western plants also became clear; and the most natural boundary appeared to be a line passing through the cities of Londonderry and Cork—a division which coincides with the partition into eastern and western already employed in "Irish Topographical Botany."

The central circle and these two intersecting lines, then, define six types of distribution which, I believe, are founded on the actual range of plants in the country. The names most conveniently employed for the "types" will be—

2. Central.
3. Marginal.
4. Ultonian.
5. Mumonian.
6. Lagenian.
7. Connacian.

the last four being named after the four provinces of Ireland, in which each type respectively reaches its maximum.

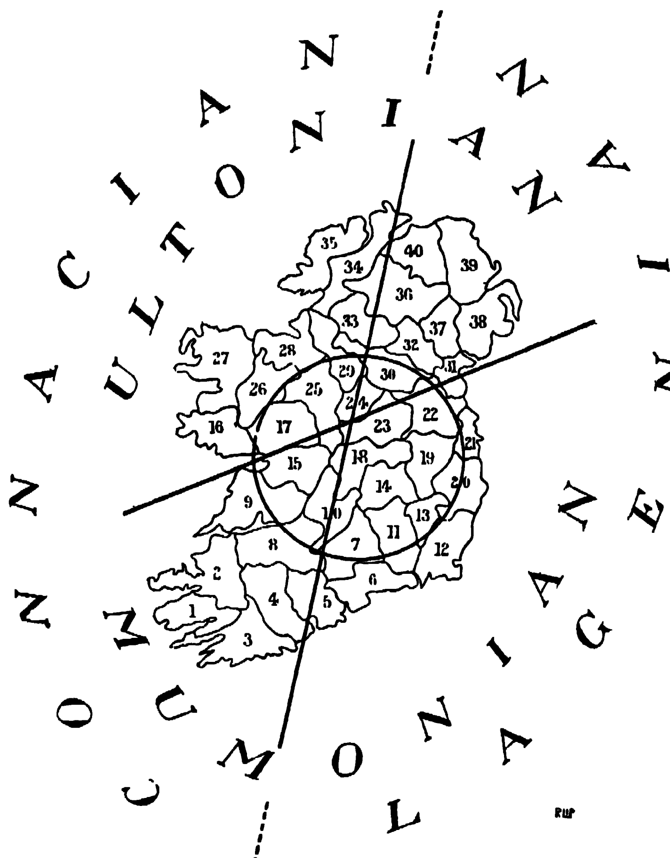


FIG. 11.—BOUNDARIES OF THE AREAS OF THE IRISH TYPES OF DISTRIBUTION.

Lists of the species belonging to each of these types of distribution, and analyses of these lists according to habitat, type in Great Britain, etc., will be found in the paper already referred to. In this place I merely illustrate the range of one typical member of each of the six groups:—

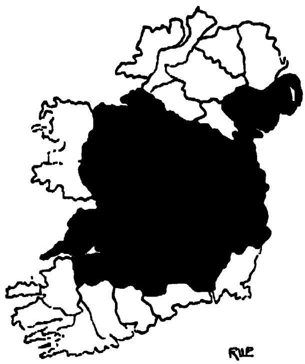


FIG. 12.—ANDROMEDA POLIFOLIA. CENTRAL TYPE.

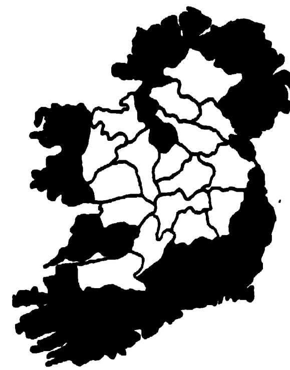


FIG. 13.—HYPERICUM ELODES. MARGINAL TYPE.

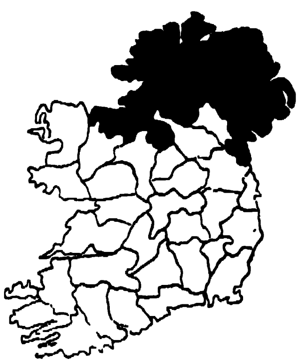


FIG 14.—CIRCÆA ALPINA. ULTONIAN TYPE.

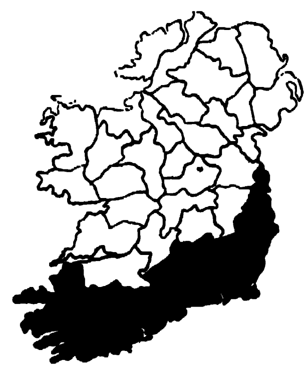


FIG. 15.—RANUNCULUS LENORMANDI. MUMONIAN TYPE.

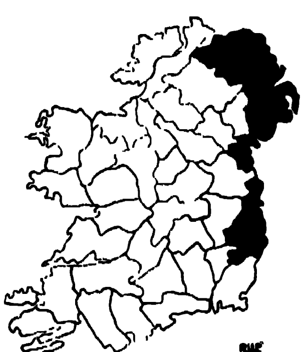


FIG. 16.—SCILLA VERNA. LAGENIAN TYPE.

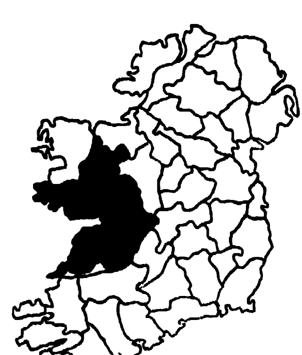


FIG. 17.—HABENARIA INTACTA. CONNACIAN TYPE.

Lastly, as to the distribution of plants which are probably or certainly introduced in Ireland. The more successful aliens, other than those of general distribution, are grouped round the margin of the island, especially in the south and east. They reach their minimum in the centre, north, and west. Their distribution, in fact, coincides with that of the indigenous "English" plants (Fig. 1), to which type belong, as will be seen from the analysis appended to the list, sixteen out of twenty-six classed by Watson. The Mumonian or Lagenian range of the aliens is of interest, for there can be no doubt that it is the result of conditions of climate and soil. In support of this view, one remarkable instance may be cited. Clover seed, imported from England, is sown widely in Ireland; official information supplied to me is to the effect that no more clover is sown in the south and east than in other parts of the country. With the clover come the seeds of the parasite *Orobanche minor*, a plant of English type, not a native of Ireland, and unknown therein until some forty years ago. The plant is now an established and spreading colonist, and its present range coincides in a striking degree with that of the group to which it belongs—the light-soil English type plants. In the central portions of its range—Wexford particularly—it is now abundant and permanent. This further emphasizes the floral peculiarities of the south-eastern portion of Ireland, which has in my paper already been demonstrated both from the presence and absence therein of certain groups of species. The great Leinster anticline is an important factor in Irish plant distribution, and a phytological boundary of marked character is formed by the line where its uplands sink into the Central Plain, and by the prolongation of that line northwards and southwards.

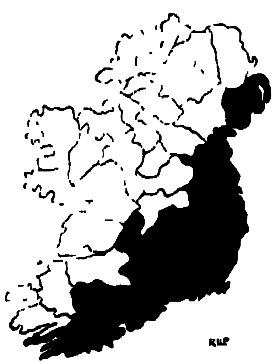


FIG. 18.—OROBANCHE MINOR.

Of the seven types of distribution proposed in this paper, five have their analogues in the types which Watson instituted for Great Britain. In both series we have a General type, and a Northern, Southern, Eastern, and Western type. While the General, Northern, and Southern in a wide sense correspond in their composition, the Eastern group of Ireland is seen to be essentially southern in Britain, while the Eastern group of Britain is practically absent from Ireland; nevertheless the two eastern groups correspond in character, representing in each case the nucleus of the thermophile and xerophile element of the flora — in England a much more intensified element than in Ireland. The Western plants of the two islands also exhibit a wide diversity in range, those of Britain being Southern and Marginal in Ireland, while those of Ireland are not to any extent Western in Great Britain, and include besides a number of species absent from the sister island. But here again the two have affinities, both being hygrophile and frigofuge in character. The two remaining Irish types, the Central and Marginal, have no analogues in Great Britain. The former consists largely of "English" species, the latter chiefly of "British" plants which do not penetrate into the Limestone Plain.

So much for the facts. The causes which lead or have led to the distribution of the flora as we now find it are difficult to determine.

The effect produced by the distribution of lime, and of open light soils, is fairly clear; but climatic effects are not so easily determined. As regards temperature, some of the characteristic plants of Connacian type are without doubt frigofuge —

in other words, their chief need in our climate is a sufficiently high winter temperature; and in Fig. 19, which shows the isotherms of the coldest month of the year in Ireland (January), parallels between isophytic and isothermal lines may easily

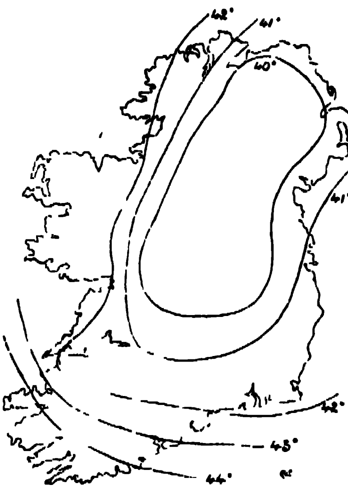


FIG 19. JANUARY ISOTHERMS.

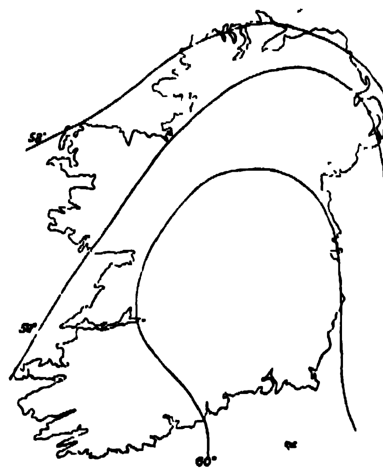


FIG. 20 —JULY ISOTHERMS.

be drawn, from among the plants of the south and west. Fig. 20 likewise, showing the isotherms of the warmest month (July), suggests that a number of the south-eastern species may be thermophiles plants for which the most pressing need is a high summer temperature for the ripening of fruit. Questions of rainfall probably effect little the distribution of plants in Ireland, since (Fig. 21) there is everywhere a sufficiency. But the limit of the Connacian type (Fig. 11) will be seen to correspond with that of the wet west-of-the-Shannon district of Ireland, while the driest area is included in that which marks the range of the Lagenian and most of the "English" type species. There is even a dry area around Galway bay which no doubt helps to produce the remarkable aggregation of "English" and "Germanic" species in north Clare. But the facts are not yet brought together, nor the observations made, which will enable us to determine how far the present distribution of plants is effected by climatic causes. Nor is this the only direction in which work is required. We can never hope to understand our phyto-geography till its problems have been attacked by the historical method. Yet the history of the Irish flora is still an absolutely unworked field.

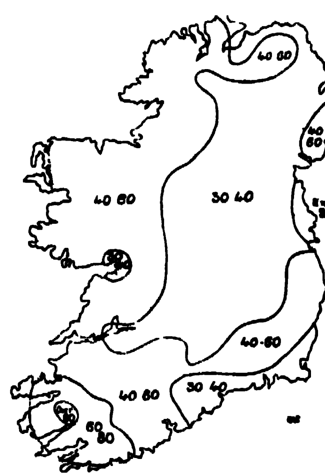


FIG. 21.—ANNUAL RAINFALL.

The records lie buried below our peat bogs and superficial deposits, and their elucidation will furnish evidence of the highest importance. No branch of Irish botany has more pressing claims on the field botanist than this.

REVIEWS.

EUROPE.

The English Lakes.

'The English Lakes.' By F. G. Brabant, M.A. Illustrated by Edmund H. New. London: Methuen. 1902.

The writing of a new guide to the English Lakes, when the task has been already performed with so near an approach to perfection as it has by Mr. Baddeley, is a somewhat bold undertaking, and one that would hardly be justified but for the somewhat different point of view adopted, and the fact that the book is an item that could hardly be omitted from the series of "Little Guides" under course of publication by Messrs. Methuen. Mr. Brabant has certainly carried out his difficult task well, though a perhaps unavoidable similarity is often to be observed between his treatment of his subject and that of his predecessor. From one point of view he possesses the advantage, for the dainty "get-up" of the volumes of the series, and the charming illustrations supplied by Mr. New, place the work on a somewhat different footing from the ordinary guide-book, which is intended for practical use rather than pleasing appearance. He has also been able to adopt a somewhat more descriptive style than is possible in the matter-of-fact directions of a guide-book pure and simple, while the arrangement is still practical and systematic. The opening section gives a concise view of the physical features, industries, history, etc., of the district as a whole, the orographical features being treated, no doubt wisely in a book of the kind, in their present form rather than in relation to geological history. Thus the Scafell group is taken as the centre of a western system from which arms radiate in all directions, while the Helvellyn and Skiddaw groups form other units. From a purely morphological point of view it seems unfortunate that the Langdale Pikes should be placed with the second group, as they so evidently belong to one of the radiating arms of the first, and the Thirlmere and Grasmere valleys form together so marked a natural dividing-line. Mr. Brabant shows an intimate acquaintance with the district, though hardly possessing the exhaustive knowledge of its every nook and corner shown by Mr. Baddeley. His judgment may occasionally be thought at fault, as when he describes the upper part of the Grasmere-Borrowdale route by Greenup Edge as "somewhat dull and tiresome." The immediate surroundings are no doubt somewhat devoid of interest, but the Edge commands one of the finest panoramas of fell-summits that are to be seen in the district. The maps, by Bartholomew, are identical with those in Baddeley, apart from the absence of gradations of colouring and their different subdivision into sections—in which they certainly do not possess the advantage. The illustrations, as already said, are perfectly charming, and possess the unusual merit, for drawings, of representing the originals with absolute fidelity of outline.

The Hebrides.

'The Outer Isles.' By A. Goodrich-Freer. Westminster: Constable. 1902.

This work, which is based on visits dating from 1894 onwards, deals rather with the people than with the physical character of the Hebrides, being concerned chiefly with questions of history, folk-lore, and the like. More nearly related to geography is the information on the industries and general manner of life of the people, with whom the author mixed freely, and whom he describes with sympathetic interest. There is a chapter on the Norsemen in the Hebrides, with an account of the remains dating from the Viking period, and the Norse element still traceable in the place-names. The book will certainly help to make the islands better known to the general public, though the picture of the prevailing ignorance of the Hebrides is perhaps somewhat overdrawn by the author.

Spain.

'The Land of the Dons.' By Leonard Williams. London: Cassell. 1902.

This work stands on a distinctly higher level than the ephemeral productions of tourists, who, after a visit, perhaps, of a few weeks, hasten to pose as authorities on a country with which they have acquired but a surface acquaintanceship. Its author, late *Times* correspondent at Madrid, has lived in the country a number of years and been a serious student of Spain and the Spaniards, so that he is able to speak from intimate knowledge of both. By far the larger part of the book relates to the people, of whose inner life and past history Mr. Williams shows a thorough understanding. From our particular point of view it might be wished that the author had devoted more space to a descriptive account of the country as well, for the solitary chapter devoted to its surface features shows that he is quite competent to speak of the geographical aspects of Spain, while works dealing with these from a general, and not too severely scientific, point of view, have not been too common of late years. Mr. Williams' remarks on the mountain ranges of Spain and their respective characteristics are of especial interest. "To one who is familiar with the country," we are told, "these mountains bear an unmistakable individualism; so much so, that were he to be conveyed blindfold to every quarter of the country in turn, and the bandage to be stripped at intervals from his eyes, the merest glance would tell him where he was, and what sierra he was confronting." In remarking on the absence of wood over the larger part of the surface, Mr. Williams shows himself a believer in a once much more extensive forest-covering, quoting an old record which speaks of a forest even in the neighbourhood of Madrid; but he will hardly be followed by those who point to the general climatic conditions of this part of the world as evidence that the land, as a whole, must always have been poorly supplied with moisture, and therefore with forest growth. For the absence of trees, he finds a compensation in the noble freedom which characterizes a typical Spanish landscape. "You may strike a line due north or south from Avila to Burgos, or Madrid to the Sierra Morena, not a soul will ask your business, never a wall or fence arrest you." The manners and customs of the people are fully described, and the past, present, and probable future of the country is in turn discussed in the three concluding chapters. Mr. Williams shows a genuine sympathy with the Spanish people, and has an especial liking for the Basques, whom he describes as the noblest-hearted and most obliging fellows in the world, while their country is "beautiful beyond description." He writes in a terse and forcible style, and has the valuable gift of presenting a complete and vivid picture in a few pregnant sentences.

ASIA.

The Hissar Mountains.

Mountainous Bokhara Results of Three Summer Journeys in Central Asia in the years 1896, 1897, and 1899.' V. J. Lipski. Part I. The Hissar Expedition, 1896. St. Petersburg, 1902. [In Russian]

In the course of the three summers M. Lipski spent in Central Asia he explored the Hissar mountains, the Peter the Great range in the Alai, the Darwaz, Mazar, and smaller groups. The volume he has lately published deals with the Hissar range, a western offshoot of the Alai-tagh, which has a length of about 200 miles, and terminates on the west with the Khazret-Sultan group. Its altitude is very considerable, most of the passes lying at a height of 12,000 feet and over, while the summits rise 1000 to 3000 feet above them. Nevertheless, they are not covered to any great extent with snow. The most extensive snowfields lie on the northern flank, where, also, almost all the glaciers are to be found. The absence of forests is striking. Trees grow only along the rivers, and there only in small clumps. The herbage also is poor. This is a result of the climate, which in general is very dry, though in the year 1896 the quantity of precipitation—rain and snow—was unusually great, causing floods which swept away the bridges over the river Tupalang, and completely destroyed the village of Sariju. M. Lipski travelled chiefly along the southern side of the Hissar mountains, which sends out lofty spurs towards the south, extending his journey eastwards into Karategin. Assisted by his companion, Captain Barshchevski, he made large botanical (10,000 specimens), zoological, and geological collections, and examined several glaciers. These terminate at a great height, none descending below 10,000 feet. They are generally covered with snow, and their extremities are buried under detritus. Vast accumulations of morainal *débris* show that the glaciers are receding, and traces of glaciers were found where none exists at the present time. As regards the geology, it seems that the core of the range consists of granite, and that limestones, diabase, and mica-schist are widely distributed. Among the inhabitants of the Hissar mountains, the most remarkable are the people of the Yagnop valley, in Russian territory, who speak a language of their own, and have a vague tradition that their forefathers came from Kashmir.

A map, tables of the meteorological observations taken, and a synopsis of the collections, are much to be desired. Probably they are reserved for the conclusion of the work. The illustrations of scenery and natives are excellent.

China.

'Travels in North and Central China.' By John Grant Birch. London: Hurst & Blackett. 1902.

The author of this narrative was drowned in the Hwang-ho by the upsetting of a raft, when attempting the descent of the river in company with Captain Watts Jones in the early days of the Boxer troubles. His diary, which is now printed in a somewhat compressed and modified form, relates to various journeys in the Chinese empire carried out in 1899–1900, with a short interval, during which he returned to this country. The first two journeys led from Peking to Kalgan and Mukden respectively, including a visit to the Ming tombs on the return from the first, and to the mausoleum of the Manchu kings, a little to the north of Mukden, on the second. On his return from England Mr. Birch undertook a more extensive journey in western China, ascending the Yang-tse to Wan-hsien above the gorges, and then starting overland through Suchwan by a route somewhat north of Mrs.

Bishop's. The province was traversed in various directions, both north and south of the capital, which was twice visited; but the most interesting journey was that from Cheng-tu north, across the highlands which separate the basins of the Yang-tse and Hwang-ho, which have still been traversed by but a few Europeans. Unfortunately the diary of this section of the journey has not been saved, and the only information available is a letter written by Mr. Birch after arriving at Lan-chau, which gives the merest outline of the main course of the journey.

The book is pleasantly written, and although a large part of it deals with fairly well-known country, it contains many interesting observations on the character and state of the country traversed, the work of the missionaries, both Catholic and Protestant, with whom the author came in contact, and the attitude of the Chinese towards European enterprise. The very brief editorial notes say nothing as to the motives which prompted the journey, and the reader is left to gather from the narrative that the writer was interested in the question of railway enterprise in western China.

From Cheng-tu, he set out north in company with Captain Watts-Jones, who, after the mishap on the Hwang-ho, was so barbarously murdered at Kwei-hwa-cheng. The route followed was in part entirely new, and led through country really belonging to Tibet, though marked as part of China in most maps. No trouble was experienced from the Mantse tribes, who have a wholesome respect for foreign firearms. Some magnificent scenery was traversed, two passes nearly 14,000 feet above sea-level being crossed, while the party was twice overtaken by snow. The alpine and other flowers, including many English kinds, were very beautiful at these high altitudes. At one of the passes Mr. Birch considers that he must have been very near the headwaters of the Ta-tung, but exploration to the west is necessary before the hydrographical system can be fully elucidated, as some of the water flowing north from the passes turns back on the plateau itself. The position of Ta-chau on the map is said to be incorrect.

It is deeply to be regretted that Mr. Birch did not survive to give a full narrative of this important journey, though his death in the Hwang-ho saved him from the worse fate which befel his companion.

The Himalayas and Persia.

'Sport and Politics under an Eastern Sky.' By the Earl of Ronaldshay. London: Blackwood. 1902.

This book is composed of two separate parts; the first dealing with sporting adventures in the Western Himalayas, the second with the author's journey from India through Eastern Persia by the newly opened trade route. Lord Ronaldshay's mountain wanderings led him through some of the grandest scenery of the snowy ranges of Kashmir (among other points, to the northern foot of Nanga Parbat, or Deomir—"mountain of the gods"), as well as across the bleak, elevated plateaus of Ladak and Baltistan; and if, in the sporting incidents which form a large part of the narrative, our sympathies are apt to be on the side of the author's victims in their somewhat unequal contest against modern weapons of precision, the picture is relieved by his keen appreciation of the wild sublimity of the scenes in which he moved, which is not shown to a like extent by every sportsman. Of the second and larger part of the book it is unnecessary to speak at length, as the journey has so recently been described in the *Journal*, while the fact that Eastern Persia, in its past and present relations, has been so recently and admirably described by Major Sykes, has of necessity somewhat detracted from the novelty of much that Lord Ronaldshay could tell us as the result of his journey. His

work indeed makes no pretensions to be much more than a "wanderer's diary." He devotes some space to a description of the country and people of Sistan, on the importance of which he insists, not merely for its great fertility, but on account of its position relatively to the surrounding countries; and bears full testimony to the influence with the people which Major Sykes has acquired by his *bonhomie* and tact. With respect to much of the other districts traversed, the impression conveyed by the narrative is one of dreary monotony and desolation, leading one to the conclusion that, in themselves at least, they can never afford an adequate occasion for international rivalry. Of Birjand, however, and its apparently increasing trade, a somewhat brighter picture is drawn.

Nepal.

'Durch Indien ins Verschlossene Land Nepal.' By Dr K. Boeck. Leipzig: F. Hirt & Son. 1903.

The author, who has visited India frequently in the course of the last twelve years, describes his book as a series of sketches from Ceylon to Nepal. In these literary sketches and the numerous photographs that accompany them, the first place is given to the native population and its daily life; architecture, particularly in the strange temples of the south, Madura and Seringham, is also well illustrated. Less attention has been paid to the better-known Mohammedan architecture of the north. Dr. Boeck was fortunate in obtaining leave, generally restricted to the Resident's guests, to visit Katmandu and its environs, and his photographs of the local architecture are numerous and interesting. From the Kakani heights, some few miles north of Katmandu, previously visited by H. Schlagintweit, he obtained a view of the snow mountains visible to the east, amongst which he was pointed out "Gaurisankar-Everest."

Syria and Palestine.

'The Semitic Series. The Early History of Syria and Palestine.' By Lewis Bayles Paton. London: Nimmo. 1902.

The general reader is here presented with a clear outline of the history of the Western Semites from the earliest times down to the establishment of the Persian empire, so far as it can be pieced together from the narratives of the Bible and other ancient sources, and from the results of the most recent explorations both in Syria and Palestine, and in the neighbouring Eastern lands with which those countries were brought so much into contact. The story of Israel and the Phœnicians will be told more fully in other volumes of the series, but the present work gives a valuable insight into the general movements of the Semitic peoples in ancient times.

AFRICA.

East Africa.

'Mitteilungen über Meine Reise nach Aequatorial-Ost-Afrika und Uganda 1896–1897.' Von Dr. Max Schoeller. Vols. i. and iii. Maps. Berlin: Reimer. 1901.

The journey of which the results are given in these volumes was carried out some five years ago, and was described in some detail at the time in the *Journal*. In his preface the author explains the reasons which have delayed its appearance, and which have even now led to some curtailment of the original plan. Of the three volumes which are to constitute the complete work, only the first and third

(which consists entirely of maps) have yet been received, and much of the most valuable material is being reserved for vol. ii. The work is produced in a sumptuous style, and, in spite of its somewhat late appearance, is to be welcomed as a valuable addition to East African literature. The greater part is taken up with the narrative of the journey so far as it relates to German East Africa, while the larger section of the route, which led through British East Africa to the Victorian Nyanza and Uganda, will be dealt with in the second volume. Though not, of course, of the nature of a systematic treatise, this narrative section abounds with instructive remarks on the various branches of science which engaged the attention of the author, especially the structural geology, and affords yet another proof of the power of observation so generally characteristic of German travellers. We find, *e.g.*, full discussions of the great fault systems which traverse East Africa, both in the Pangani region—where the original rift-character is still traceable, though modified by subsequent river-erosion—and in that of the "Natron" lake, a careful comparison being also drawn between the two regions. Economic questions are also touched upon, especially with regard to Usambara, the possibilities of which the author is disposed to rate highly. A zoological discovery was that of the existence of the striped hyæna in German East Africa, which had not been proved before; while a striking picture (recalling those of Sir Harry Johnston) is drawn of the bird-life of the Olgeju lagoon, the central of the three basins into which the "Natron" lake is divided.

The text of the first volume concludes (apart from a section devoted solely to sport) with a very brief summary of the scientific results under the head of cartography, geology, botany and zoology, and ethnology. The route-map, which was the work of Herr Kaiser, is reproduced in vol. iii. in a number of sheets, on, perhaps, an unnecessarily large scale, for it depends solely on the work of the expedition, no other maps being utilized. It is based on careful compass surveys, controlled by bearings to prominent peaks; but whether, in cases of divergence from previous maps, which are not unfrequent, greater reliance is always to be placed in the newer work than on the old, is not easily decided. An extensive series of altitudes, determined by aneroid observations, is given, and these results also differ considerably from those of other travellers. The fact that several instruments were used, so that one checked another, gives some weight to the results, but these do not seem to have been controlled by simultaneous observations at sea-level. A meteorological record was also kept during the journey. In his suggestive sketch of the geological history of East Africa, Dr. Schoeller holds to the view that a land connection with India and South America was maintained through Jurassic times, owing to the similarities observable in the littoral forms of Mollusca dating from that time. Attention must lastly be drawn to the fine series of photographs of native types, though the ethnological remarks are reserved for the second volume.

FRENCH CONGO.

Émile Gentil, 'La Chute de l'Empire de Rabah.' Paris: Hachette. 1902.

A stirring chapter in the history of the partition of Africa is supplied by this volume, which deals in a concise yet comprehensive manner with the latter stages of the French advance from the Atlantic coast to the shores of Lake Chad. No one man has played a more important part in that advance than M. Gentil, who, whatever may be the future of the territory, will deserve to be remembered, side by side with his predecessor De Brazza, as one of the chief instruments in the realization of the French dream of territorial extension in Western Equatorial

Africa. Even before 1895, when he started on his first important mission to the far north, his thoughts had, during several years' service in the colony, been turned with longing towards the great lake of the Central Sudan, but it was only in the year mentioned that his opportunity came, by promptly seizing which he soon acquired a foremost place among French African pioneers. The present narrative starts from the expedition of 1895–98—which resulted, as is well known, in the placing of the first steamer on the waters of the Shari and the successful navigation of that river to Lake Chad—and recounts the various stages in the story of the French advance, until the last obstacle was removed by the defeat and death of Rabah. M. Gentil's principal attention is naturally directed to the events which are the theme of his book, and the geographical information conveyed is merely incidental to the course of the story. Something is, however, to be learnt of the hydrographical system of the Shari, which throughout played so important a part as a highway to Lake Chad, as well as of the various tribes which inhabit the country and the native politics of the Central Sudan. The fear inspired by Rabah in the peoples he oppressed is frequently insisted on, and there is no doubt that by overthrowing his arbitrary power, M. Gentil and his coadjutors advanced the prospects of civilization in this region. The direct relations maintained between the adventurer and the Mahdists was shown by the capture of two standards sent by Mohamed Achmet to the usurper of Bornu, as symbols of suzerainty. Some light is thrown also upon the position of affairs in Wadai and the spread of the Senussi movement, though the most recent developments in this direction have occurred since the book was written. M. Gentil does not confine himself solely to his own personal work, but speaks also of that of his coadjutors, giving information, *e.g.*, as to the mission of M. Bretonnet, as well as on the ill-fated mission of M. de Behagle, whose death seems in great measure to have been occasioned by his own rashness. The purely geographical results are summarized in an appendix which tabulates the astronomically fixed positions. Of these the latitudes were obtained by circummeridian altitudes of the sun and stars, while the longitudes of the principal points are based on equal altitudes, and of the rest, by a double transport of time from the first. The main climatic characteristics of the territory are also sketched, three distinct zones being described as lying between 5° N. and 6° 45′; 6° 45′ and 9°; and 9° and 13°, respectively, the last-named parallel marking the commencement of Saharan conditions.

The Moors.

'The Moors. A Comprehensive Description.' By Budgett Meakin. London: Sonnenschein. 1902.

In this, the concluding volume of Mr. Meakin's important "trilogy" on Morocco, its people and history, we are presented with an amount of original matter which to some extent gives the work an even higher claim to recognition than its two predecessors. In dealing with the history and geography of the country, Mr. Meakin was naturally dependent more or less on previously published matter, though his untiring researches through the whole range of Moroccan literature, much of it little known even to students, placed his volumes far above the level of mere compilations. The present work, however, is based almost entirely on investigations at first hand among the people themselves. In the execution of his self-imposed task of describing the Moors in their most intimate social and religious relations, Mr. Meakin spared no pains to qualify himself by long residence in the country, during which he lived as a native in native dress, and was thus able to study the people, not as an outsider, but as one of themselves; while the accuracy of his

picture is further vouched for by the fact that every one of his notes was submitted to the criticism of a representative group of natives before being incorporated in the work. In this way many inaccurate ideas respecting the Moors have been brushed away. The various aspects of Moorish life and character are depicted in an exhaustive fashion, the author taking as his model Lane's famous treatise on the Modern Egyptians. Some of the information is of considerable value in connection with current events, especially that relating to the general attitude of the people to outsiders and the conditions of trade and industry in the country.

Nigeria.

'British Nigeria. A Geographical and Historical Description of the British Possessions adjacent to the Niger River, West Africa.' By Lieut.-Colonel A. F. Mockler-Ferryman. London: Cassell. 1902.

This is an extension of the section on Nigeria in the author's former work on British West Africa, the old matter being revised and partially re-written. It forms a useful compendium of the history of the Nigeria Protectorate, both under native rule and since the first introduction of British influence, with a sketch of its present condition and prospects. The people and their customs are described at some length, with some items of folk-lore.

Tripoli and Tunis.

'Aus den Staaten der Barbaresken.' Von Dr. E. Dagobert Schoenfield. Berlin: Dietrich Reimer. 1902

This work consists of two parts; the first dealing with Tripoli, the second with Tunis. The section on Tripoli is perhaps the more valuable, as existing literature on that country is more scanty. The author spent three winters there, made a journey in the Fezzan deserts, and visited the ruins of Leptis Magna; but besides describing his own experiences, he has much to say on the general characteristics of the land and its inhabitants, and the present political situation. The illustrations are of unusual excellence.

AMERICA.

Irrigation in the United States.

'Irrigation in the United States.' By Frederick Haynes Newell. New York: Crowell & Co. 1902.

Mr. Frederick Haynes Newell has, for twelve years, been engaged in investigating the problem of irrigating the arid regions of America. His book does not profess to be a technical one, but rather one which will give, to the amateur and the farmer, a general idea of the methods and systems by which homes may be made in tracts which, at first sight, seem inhospitable and desolate. He speaks of water as the substance which, more than any other, affects the health and industries of man, especially in all agricultural pursuits. The first chapter gives a map, showing that, while the well-watered lands near the east and west coast of America have passed out of the hands of Government into private occupation, there remains in the central arid regions a vast area of vacant public land, about two-fifths of the whole area of the States, which should, both in the interests of the State itself and of the increasing population, be made available for settlement as far as the available sources of water-supply admit. Mr. Newell points out that the laws, which regulate the disposal of public lands

in square chess-board blocks, are suitable to those tracts where cultivation without irrigation is practised, but are not suited to areas in which the division of farms must be regulated mainly by the physical features of the country, and especially by the possibilities of irrigation. These possibilities are gauged by the volume of water which can be obtained from the rainfall. A series of diagrams and maps are given, showing the intensity of the rainfall in different parts, and the proportion of that fall which runs off the land; this proportion is, naturally, least in the arid regions and greatest in the humid ones, and it varies from 50 per cent. in tracts of heavy rainfall near the coasts, to nothing at all in some places where the entire rainfall is absorbed and ultimately lost by evaporation.

The effects of irrigation in the arid regions of America are illustrated in the book by pictures of the land before and after irrigation works have been constructed. It is said that without irrigation 20 or 30 acres in some parts will support one cow only, but, with irrigation, will feed ten times the number of cattle, or will support a family of three to five persons. The Papago Indians of the south-west appear to have learnt the value of irrigation, for they construct little dams when it rains, and lead the water from the gullies in the hilly ground into a series of hastily constructed terraces, in which they plant their crops. Some 95 per cent. of the vacant public lands are classed as deficient in water-supply, and it is recognized that, owing to the impossibility of providing the necessary water, only a small portion of the whole can be reclaimed for agriculture; but this small portion is some 60 to 70 millions of acres in extent, and large enough to support millions of people if the necessary works are carried out. In order to do this, a regular system of surveys and investigation of the sources of supply and possible sites for reservoirs has been in progress in America for years.

The author, after giving a brief description of the simplest methods of ascertaining the volume of water which is flowing in a stream, mentions the difficulties which have arisen as the number of small canals, or "ditches," as they are called in America, have increased on a river, and the different owners of them have disagreed as to their rights to the available supply. These disputes are brought prominently forward when there is any scarcity of water, and have led to violence and disorder. One method of adjusting such disputes has been for the various irrigators from a particular stream to appoint one of their number to distribute the available supply, and to fix certain days and hours when each claimant may draw off his proper share. This is a system well known on the great canals in Egypt and India, where regular "tatils," or systems of rotation, are established by Government according to the necessities of the case.

Chapter IV. describes various devices for measuring and dividing the volume of water in small channels; it refers to the curious "miner's inch," which had its genesis in the mining districts, when a comparatively small volume had to be divided among a number of miners. The measuring box, illustrated on p. 127, is ingenious, and would be of practical use in many irrigating systems where a "head" of water is available. In some parts of the world water is sold for irrigation by volume, but, so far, no satisfactory module has been found which will work well in cases where there is no marked difference in level between the main channel and the one into which the water has to be measured, and which will not choke with weeds or floating sticks. In India such difference in level is not often available, and the water is always sold by the area irrigated, without reference to the volume used—a system which encourages waste on a large scale.

The cheapness of timber in America has led to the use of that material in irrigation works to a larger extent than in other parts of the world. Mr. Newell describes the "flumes" of various kinds, which are made for the carriage of

irrigation supplies across valleys and over rivers, or under other channels. In some cases these flumes are made of circular sections, bound together with external bands of iron, so forming a continuous wooden pipe. These often extend for considerable lengths, winding, like great snakes, through the woods, along the hillsides, and up and down across the valleys.

The chapter on reservoirs is full of interest. Large tracts of land in America, in Africa, in India, and, indeed, in many other parts of the world, can only be efficiently cultivated if the flow of the rivers is regulated, and their waters conserved, by impounding the surplus of one period for use in irrigation at a later time. Mr. Newell gives, first, a word of caution, pointing out how many disappointments there have been with reference to this class of irrigation works; how often comparative failure and financial loss have followed when projects have been carried out by engineers who have accepted the statements of the "oldest inhabitants" as to the volume of water to be secured, instead of conducting, through a number of seasons, the necessary gauging of the streams in order to correctly ascertain the amount of water which a given area of country would supply. This chapter would have been doubly interesting to those engineers who have to deal with such matters, if Mr. Newell had given the results of his experiences as to the proportion of the flow-off from a catchment which could be obtained under varying conditions of soil, of climate, and of rainfall. The question is one of great and growing importance, as the increase in population is demanding more and more, in all parts of the world, and notably in South and East Africa, the construction of works to impound the rainfall. Such works require the construction of dams across valleys to form the reservoirs, and we have in this chapter a brief description of "rock filled" dams, of masonry dams, of wooden dams, and of earthen dams. The latter are constructed in America sometimes by the hydraulic process, by which the material to form the dam is both excavated and carried to the site by streams of water flowing at high pressure. The speed and small cost at which material can be moved in this way is extraordinary, but the system, of course, is only possible where water, at high pressure, can be obtained, either naturally or by pumping, at a very moderate cost.

The great value of water has led to many plans for its economy; among these the system of sub-irrigation of orchards and root-crops is one of the most remarkable. Under this system the water is not applied to the surface of the ground, as is usually the case, but is conducted by perforated underground ducts to the neighbourhood of the plants. The system has not been very successful in orchards, owing, it is said, to the roots, in their eagerness to get to the water, seeking out the ducts, choking the outlets, and wrapping themselves round the pipes; in the case of root-crops the system has answered, as the crop is removed every year, and the roots do not choke the pipes. This system must be a very expensive one in first cost.

In every irrigation system the most important factor is the "duty" to be obtained from the water. This "duty" is expressed in different terms in different parts of the world. In India it is usual to measure it by the number of acres which can be irrigated by 1 cubic foot a second flowing for a certain time. In Egypt it is usual to measure it by the cubic metres of water supplied to an acre in twenty-four hours. In America it seems to be usual to measure it by the number of inches in depth which it is necessary to apply to the field in the season. The "duty" of water varies greatly in different soils, in different climates, and for different crops; the statistics given in Mr. Newell's book are useful so far as they go, and it is remarkable that in some of the States laws have been made fixing the duty for apportioning water at the high rate of 66⅔ acres per cubic foot per second.

This, in an irrigating season of one hundred days, is equivalent to a depth of 36 inches in the field, which is a very large volume.

The sums paid for irrigation vary greatly. In South Africa £1 to £1 3*s.* an acre is paid; in India the average charge is about $2\frac{1}{2}$ to 3 rupees, or say 4*s.* an acre; in Egypt cultivators will pay £2 to £3 an acre, in addition to the ordinary land tax, for water pumped on to cotton-fields; in America Mr. Newell gives the average as $\$1\frac{1}{4}$, or say 5*s.* an acre, but the rate is in some cases (p. 326) as high as $15 and $30 per acre for an aggregate depth of 1 foot of water delivered on the land.

The researches made by the American officials have shown that, in the arid states of America, there is estimated to be a sufficient supply of water, if it is conserved by reservoirs and other irrigation works, to render 60,000,000 acres culturable. Of this area some 4,000,000 acres was actually irrigated in 1890, and some 7,000,000 acres in 1900. The increase in area is great, and compares favourably with the progress made in an equal period in India, where the Government, encouraged by the fact that the existing irrigation works pay collectively about 6 per cent. on the capital invested in them, has appointed a commission on the subject, and it is anticipated that a large extension of irrigation works will be the result.

Mr. Newell, in the latter half of his book, deals with underground water-supply, with irrigation law, with irrigation by pumping, and he gives a general description of the irrigation in the twelve territories which lie in the arid tracts. The book is illustrated by numerous sketches and plates, and it will be useful, not only to those who are interested in irrigation from a purely agricultural point of view, but also to irrigation engineers, who will find in it many facts of value to them in their profession.

R. B. Buckley.

South America.

'The Great Mountains and Forests of South America.' By Paul Fountain. London, etc.: Longmans. 1902.

Like its predecessor, which treated of the wild life of the southern half of North America, this work will be welcomed by those nature-lovers who prefer pictures of bird and animal life in its natural surroundings to dry scientific treatises. From their point of view, it is perhaps the most attractive book on South America that has appeared for many years. The writer makes no claim to be a geographer, and his somewhat fragmentary notes of travel in the inner recesses of the continent (including a voyage on the Purus) hardly add to our knowledge of its topographical features. But his graphic word-pictures of natural scenes, whether in the Andes or the great forests of Brazil, are valuable as bringing home to the mind with unusual force the typical characteristics of the different regions of South America.

GENERAL.

Maps and Map Reading.

'Notes on Maps and Map Reading.' By Lieut.-Colonel H. M. E. Brunker. London: Clowes & Sons. 1902.

This is a useful little book which essays to reduce a special branch of military education to a few practical and elementary rules.

In the introduction it is satisfactory to hear that the War Office regulations of May, 1902, at last recognize the value of small-scale maps for purposes of military instruction. A scale of 1 inch per mile is the very largest which is applicable to

such wide areas as modern armies will manœuvre over in the course of a campaign, whilst it is quite probable that the scale of 4 miles to the inch will be found to be the best standard scale for practical purposes in the field.

Recognizing this fact, the writer has placed far too much stress on the reading of contours. Accurately contoured maps on the scale of 1 mile to the inch will never be attainable of any country that has not been subjected to a rigorous course of exact survey. For larger-scale maps and purely local purposes the contour is, of course, the only scientific method of showing relief, and a knowledge of their significance and a capability of rapid interpretation of them is undoubtedly an important item in technical education. But for the smaller-scale maps (which will be the standard military maps of the future), the continuous contour system of topography will inevitably be found to be inapplicable to any but comparatively level country. For mountainous country it is misleading and dangerous. The scale does not admit of a less vertical interval than, say, 100 feet, and a 100-foot hill may be a very important military feature. This on the map would only be represented by one single line, or loop, and that single line might represent (if not marked by figures) a depression rather than an elevation. Moreover, accuracy of contouring by mere eye sketching (such as is necessarily resorted to in most military map-making) is very unequal. The American 1-inch standard maps are perhaps the best example of the system, but for the vast mass of the unmapped countries with which England has yet to deal, the elaboration of American methods will be found impossible. Even when possible the result is admittedly misleading in detail. Consequently officers and men should be equally trained in the far readier processes of map-reading from topographical illustrations of the Indian Survey type, where eye sketching by means of hachuring takes the place of contours; where elevations and depressions are unmistakably differentiated; and where relative heights are determined at once by actual figures on the face of a map. To cover the face of a military map with figures denoting height above a given datum is the really practical way of giving instant information to the map-reader of a small-scale map. Cover from the fire of an enemy, etc., may be a matter of a few feet of elevation more or less. Such details cannot be expected from small-scale maps—not even from the 1-inch Ordnance maps of the English Survey.

Colonel Brunker's book marks a long step in the right direction. He does not tell us everything (*e.g.* how to "set" or "orient" a map that is not mounted on a stiff board), but it is useful all through. The doubt about it is the uncertainty whether he has quite grasped the nature of that map of the future which must inevitably be used on the field of action if lives or opportunities are not to be thrown away.

T. H. H.

History of Geography.

'Manuali Hoepli.' L. Hugues. Cronologia delle Scoperte e delle Esplorazioni Geografiche, dall' anno 1492 a tutto il secolo xix. Milan: Hoepli. 1903.

Prof. Hugues here gives a carefully compiled summary of geographical exploration from 1492 to 1900, arranged chronologically. It should prove most valuable for purposes of reference, forming as it does to some extent, with the help of the excellent index, a much-needed Dictionary of Geographers. The list of names is fairly exhaustive, including many less-known travellers, as well as writers like Glareanus and Varenius. Some mistakes and omissions were no doubt unavoidable. Thus, Sir H. Johnston appears (once only—under 1883) as N. H. Johnston, and we miss the name Ravenstein, though we find such names as Ruge, Hamy and Gallois duly entered.

THE MONTHLY RECORD.

THE SOCIETY.

Award of the Victoria Medal to Dr. Sven Hedin.—At the meeting of the Council of the Society on December 8, it was decided to recognize the great importance to geography of the scientific work performed by Dr. Sven Hedin in Central Asia, by the presentation of the newly instituted Victoria Medal, awarded for the first time in 1901 to Mr. Ravenstein. As will be remembered, this medal is to be given, not annually, but as occasion may arise, to such travellers or geographers as may be regarded as entitled to special recognition for the value of their work. It thus to some extent takes the place of the special medals which have in the past been awarded to such travellers as Stanley or Nansen, who have already been holders of the ordinary medals, but whose further services to geography have called for some additional recognition by the Society. Dr. Sven Hedin occupies a similar position, having received the Founder's Medal in 1898, after his return from his first great expedition, while the high appreciation in which his work is held is further shown by the fact that the award has probably been made for the first time on an occasion other than the Anniversary Meeting of the Society. It has quickly been followed by the presentation to the explorer, during his visit to Edinburgh, of the special "Livingstone" Medal of the Scottish Geographical Society.

EUROPE.

The Basin of the Arno.—In the *Rivista Geogr. Ital.*, June and July, 1902, Prof. Oberti treats of the hydrographical history of the Arno basin. After discussing the uncertain morphology of earlier geological periods, he states that in Pliocene times the Arno did not exist, but that the lake of the Mugello was drained through the lower lake of Montevarchi and the Val d'Ambra to the sea, while a lake in the Casentino valley sent its waters to the site of the present plain of Arezzo, and thence through the lagoon of the Chiana valley to the gulf of Chiusi. Towards the end of the period orogenic movements of such intensity occurred as to define the present morphology of the basin. The land rose to the south-east and sank to the north-west, while a fault on the line Florence-Signa drew off the waters of the lake of Mugello and Valdarno to the west, where they reached the sea beyond Cascina. The waters of the upper Arno basin, no longer finding an outlet by the Val d'Ambra, rose till they poured out into the Sieve. A lake of no great size remained in the lowest part of the Casentino valley, partly separated from the Arno basin, and communicated by the narrows of Chiani with the lacustrine basin of the Val di Chiana, the waters of which, joined by those of the lakes of Perugia, Montepulciano, and Chiusi, made their way to the Tiber. The narrows of Chiani became the dividing point between two opposite tendencies—active erosion in the north and deposition of sediment in the south—so that the streams on the northern side tended more and more towards the Arno, which gradually extended its basin southwards. Prof. Oberti gathers from various writers the history of this southern displacement, and mentions the engineering works erected to check it in the seventeenth and eighteenth centuries.

Settlements in the Netherlands.—A series of interesting articles by Dr. H. Blink, on the settlements on and around the Drente plateau, has appeared in the *Tijdschrift* of the Royal Dutch Geographical Society, Deel xviii. No. 5, and Deel xix. Nos. 1, 4, and 6. Hitherto the history of settlement in Holland from an anthropogeographical and economical standpoint has been little studied, and Dr. Blink desires to fill the gap. He has chosen the Drente plateau for the subject of his first essay, because settlements of very old and more modern types occur here side by side. He describes the old German colonies on the edge of gently sloping hills which presented good ground for cultivation. The villages were built in irregular groups of houses with open spaces between them. In the fen colonies, on the other hand, the houses skirted the roads, paths, or canals in long rows. Dr. Blink describes how turf-cutting and cultivation progressed hand-in-hand in the Groningen fen colonies, and how the development of the peat industry led to the construction of canals and the growth of shipping as the peat was carried to more and more distant markets; and treats of the manufactures that have sprung up in more recent times. The details concerning the various land tenures, the houses and the mode of life of the villagers, the systems of working the peat, etc., combine to form a very instructive picture of past times in Eastern Holland.

North Sweden as an Agricultural Country.—The adaptability of the northern part of Sweden for cultivation has been keenly debated, and very opposite opinions have been expressed; some of the disputants maintaining that the natural conditions prohibit any great development of agriculture, while others dream of colonization on a large scale. In *Ymer*, No. 3, 1902, Prof. Högbom sets forth the actual conditions. As regards climate, he points out that North Sweden has the advantage of Finland in that the night-frosts are more severe in the latter country, where, however, the agricultural population is more numerous. If, too, the crops obtained in Northern Sweden be compared with those of Southern Sweden, it appears that the yield is not less than on average lands further south. Prof. Högbom then passes in review the physical conditions of the country, dividing it into four regions—the coast and fringing belt of islets and rocks (the *skärgård*); the region of marine clays and river sediment; the region of moraines and bogs; the highlands and lake district. Along the coast and *skärgård* the finer particles have been washed away by the sea as the land has risen, and this process is still going on. Only in a few sheltered spots are small areas of available soil left behind. The second district extends inland to the highest level reached by the sea after the inland ice melted away and the morainic deposits were left. This limit varies in different parts from 650 to 900 feet above the present sea-level. Here the sand, light soil, and clay washed out of the moraines are deposited in the valleys and low-lying lands, and old river deltas form good land for the farmer. This is the agricultural land of the country *par excellence*. Adjoining it is the region of morainic accumulations and large bogs, where the material of the moraines covers most of the surface and has not been sorted by water, so that the ground is for the most part encumbered with stones, and cannot be utilized, though the chemical constituents of the soil render it naturally fertile. The bogs, some of which are 6 or 7 miles in extent, are, and might be more extensively, utilized as meadow-land. In the region of the highlands and ice-lake sediment the valleys are often filled with fertile soil collected by lakes and streams, and cultivated lands are found as high as 1600 feet above sea-level. These are especially productive where they contain lime derived from the Silurian formation of central Jämtland. The elevation and climate are the chief obstacles to cultivation, but the frosts are less severe than might be expected. Prof. Högbom has collected statistics showing the growth of population and extension of agriculture, etc., in the various regions, and exhibits these details in a map and diagrams.

Lakes of the Kostroma Government.—The valley of the river Kostroma in its middle and lower course lies 230 to 390 feet above sea-level, while in the source-region at Soligalich the normal height of the river is only 436 feet. Its valley is about 20 miles broad in the lower part, owing to the combined action of the Kostroma and Volga, which flows up the Kostroma in spring to a distance of 40 miles, checking the current of the latter and causing much erosion of the bed-rock and deposition of alluvium. At the present time the spring flood does not extend to the limits of the valley, which were evidently at a former period, before the river-beds were cut down so low, the banks of a great lake. The basin of the river and its tributaries, a hilly belt that slopes south-eastwards to the Volga from the boundary of the Government, is now studded with a number of small lakes, some of which were examined by M. Grachef in 1901. In the neighbourhood of the lakes in the Uzoksa valley the villages are built on piles 3 feet 6 inches to 12 feet high, according to the situation, for in the spring large tracts are flooded, and these villages stand, like Venice, in the midst of the water, communication being possible only by boats. As the land is so long covered by water, the only crop that can be raised is hops. The hop-yards extend over large areas, yield a good profit to the inhabitants, and supply the chief article of trade. The chief lakes described by M. Grachef are the Velikoye, Sloinskoye, and Idolomskoye, in the basin of the Uzoksa (or Uzoka), right-hand tributary of the Kostroma; and the Galich, Chukhloma, and Gushcha, drained by eastern tributaries of the river. The largest of all is the Galich, with an area, according to Strelbitski, of 29¾ square miles. The water is shallow, the greatest depths occurring along furrows which seem partly to form continuations of the beds of the streams that feed the lake, partly to follow the line of the banks. At high water the river Beksa flows back into the lake and raises its level. The lake is frozen over from about November 7 to May 7. The Gushcha lake slopes down to a hollow near its northern bank. The depth of sudden change of temperature (*Sprungschicht*) is at 26 to 30 feet (temp. 38° Fahr.); in shallower places the water gradually cools (in July) from 76° at the surface to 44° at the bottom. The water of the Pokheyevskoye lake, which has a bottom of firm clay and bare banks, is peculiarly transparent. The following table gives the dimensions, etc., of some of the largest, deepest lakes:—

	Max. length in miles and furlongs.		Maximum breadth in miles and furlongs.		Maximum depth in feet.	Mean depth in feet.	Transparency in feet.	Colour in the Ule-Forel scale.
Galich	10	5	4	0	14·8	5·4	2·5	—
Chukhloma ...	5	6	4	8	14·8	4·9	—	—
Gushcha ...	0	2·6	0	1·8	68·2	23	1·6	20
Pokheyef ...	0	2	0	1·8	62	29·5	14·8	—
Velikoye ...	1	5	1	2	6	2	4 to 6·5	16 to 17
Idoloma ...	1	2	0	4·5	—	4		

Zemlevedeniye, Nos. 2 and 3, 1902.

ASIA.

Mr. C. W. Campbell's Expedition in Mongolia.—Mr. C. W. Campbell, of H.M. Consular Service in China, who first became known to geographers for his journey through Korea to the Ch'ang Pai Shan, described before the Society in 1892, has lately returned to this country after accomplishing an important journey through Eastern Mongolia, extending in all to about 2500 miles. Parts of his route have probably not been traversed previously by Europeans, while he appears

to be the first Englishman (at least, who has given any account of his journey) to travel at all in Eastern Mongolia and the Kerulon valley.* The expedition had been planned for 1900, but was then frustrated by the Boxer troubles. The start from Peking was eventually made on June 3, 1900. Proceeding *viâ* Kalgan, Mr. Campbell reached the Anguli Nor, and then made a tour north and north-east through Chaharia by an unbeaten track to Dolon Nor, visiting the old Yuan capital, Shang-tu, on the way. He then visited the Dalai Nor, and thence went north and north-east to the Khalka river, which he followed for some days to the north of Buir Nor, afterwards striking across to the Kerulon, and getting a view of the great Dalai Nor from a hill called Bogdo-ul. The Kerulon was followed to the district of the Tsetsen Han, overlord of the Western Khalkas, whence Mr. Campbell struck across to Urga, which he reached on September 6. From Urga he made two long trips and one short excursion, during which he visited the Kentei mountains, traced the Kerulon to one of its sources, and finally traversed the Orkhon valley, visiting the old Turkish monuments brought to light by Yadrintseff and Radloff, the ruins of the old Uigur capital, Hara-balgas, and the celebrated monastery of Erdeni-tsu, the probable site of the ancient Kara-koram. On the main journey to Urga he was accompanied by an Indian sub-surveyor lent by the Indian Government, who executed a survey with the plane-table, while Mr. Campbell himself made a series of barometrical and temperature observations, took observations for latitude and compass variation, and put together a fair collection of plants. It is interesting to compare this journey with that of the old Jesuit traveller Gerbillon, whose journeys led, broadly speaking, over much the same ground in the seventeenth century.

Minerals and Mining in Korea.—So much has been written on the subject of the mineral resources of Korea, that the report of the British Consul at Chemulpo with regard to the question will be read with interest. The American gold-mining concession at Wonsan employs over four thousand Korean labourers, works five mines, and has exported gold to the value of £150,000 during the past year. A British company has commenced work on a powerful vein of pyrrhotine carrying copper for a width of 13 feet, and have also discovered seams of coal of a highly anthracitic character.

The Kirghiz Steppe in the Semipalatinsk Government.—In 1898 and 1899 M. Tikhonovich, with three companions, investigated the Kirghiz Steppe with the object of ascertaining the general condition of the water-supply and the capabilities of the soil for cultivation. His journeys extended over some 44,000 square miles, between 48° and 53° 40′ N. lat. and 75° and 81° E. long. The steppe is in general a plain, the highest point, in lat. 51° 30, having an absolute elevation of only 650 feet, while the Irtish sinks from a height of only 423 feet at Pavlodar to 143 feet at Omsk, after a course of 260 miles. In the south a ring of mountains, culminating in the Kizil-ra (the Kizil-tash of Semenof), 5080 feet high, forms the watersheds between the Irtish and the Balkash lake and between the Irtish and Ishim. On the Balkash slope there are numerous streams, but hardly any lakes; in the elevated country there are lakes fairly well supplied with water by streams; and in the steppe lakes are numerous, while almost the only river is the Irtish. In the Barjanauly and Karkarali mountains some of the lakes are of tectonic origin, being connected with the strike of the folds and the slope north-north-westwards, in which direction the sea of early Tertiary times

* Mr. T. W. Atkinson's furthest point in this direction seems to have been Nerchinsk, in the valley of the Argun, but it is not easy to separate the descriptions in his work which are based on his own travels from those derived from Russian works.

receded. Other agents, chiefly eolian, played only a secondary part in their formation. Other lakes, as the Kara-sor (a *sor* is a lake which dries up in summer) and Balikti-kul, are due rather to the action of the wind on loose deposits, many of them lying in coal-bearing strata of little consistency. There are signs, however, that water-erosion was formerly more active in this region, and possibly has assisted in the excavation of the Kara-sor. The remaining lakes may be divided into old lakes of the primeval steppe, old lakes of the old coast belt, and lakes formed in the Post-Pliocene period. The first are connected with a negative displacement of the coast-line in the Oligocene period, the second with abrasion during the early Tertiary transgression, and the third are the result of the level surface of the steppe. The last are fresh or only slightly brackish, and lie at a higher level than the salt lakes in basins of Oligocene clays. The tectonic basins in the mountains are fairly supplied by streams. In general the lakes are disappearing, but this does not prove that the whole region is drying up. Besides common salt, the waters of the lakes contain potassium oxide, chloride, and sulphate, calcium sulphate, magnesia, magnesium chloride, alum, etc.

The Founding of Fort St. George, Madras.—Mr. William Foster, whose previous contributions to our knowledge of the early trading operations of the English in India are well known, has placed students under a fresh obligation by the publication of extracts from early documents relating to the founding of Fort St. George, which have hitherto been hidden away in the India Office records. As Mr. Foster points out in his preface, the history of Madras and its fortress has been dealt with by many historians, but the records to which these have had access have been limited to those available in the city itself, which commence only in 1670. The present selections, many of them taken from the important collection of "original correspondence" preserved at the India Office, take us back to the first establishment of the settlement and its history under Hindu rule, and therefore supplies a hitherto missing chapter of great interest. Mr. Foster weaves his extracts with much skill into a connected narrative, allowing the old writers to tell the story in their own words where possible, but supplying the necessary connecting links and elucidations, sometimes gathered from contemporary Dutch records. Before the founding of Fort St. George, the English had been established at Masulipatam, where they were subject to the exactions of the Mohammedan rulers of Golconda and their satellites, and were placed at a great disadvantage as compared with the Dutch, who had a settlement at Pulicat, some 200 miles to the south, under the milder administration of the Hindu king of Vijayanagar. In 1626 they obtained a grant of land at Armagon, a little north of Pulicat; but the conditions here too were unfavourable, and the English factors were ready to seize any opening for the establishment of a post still further south. The desired opportunity was afforded by the overtures made by the Naik of the district round Madraspatam, as the site of the future city was then called. In the negotiations with the Naik, as also in the actual founding of the fort (1640), the details of which are fully elucidated by Mr. Foster's extracts, Francis Day played a prominent part, showing much determination and initiative, though ill supported by his superiors. Much of the responsibility was, however shared by Andrew Cogan, to whom, Mr. Foster thinks, sufficient credit has not hitherto been given for his part in the undertaking. Several misstatements which have obtained currency with regard to the founding of the settlement are also corrected. Thus Mr. Foster shows that the original grant by the king of Vijayanagar was not made by Sri Ranga III., as is usually stated, for he had not then come to the throne; also that it did not hand over a district 5 miles long by 1 mile wide, for in 1645 the English appear to have possessed only Fort St. George and its

immediate vicinity. The original name given to the settlement was Chennapapatam, after the father of the Naik, whence comes the present native name of Madras—Chennapatam. But the old name held its own with the factors. The first instance of the abbreviated form occurs in 1642 (as Maddaras); but as in the original the word comes at the end of the line, and has a mark of contraction over it, we cannot infer that this form had yet become general.

Perim Island.—Miss Raisin, D.SC., describes Perim in a paper on the geology of Perim island in the *Geological Magazine* (May, 1902). It is about 3 miles long, and 1½ mile distant from the mainland on the east, and 9 to 10 miles on the west. It rises in a horseshoe shape, open to the south, out of a shallow sea, the 5-fathom line curving into the harbour. Low plains, evidently raised beaches, under 12 feet above the sea-level, form about half the island, and the hills above this plain rise to 249 feet. The foundation rocks of the island are volcanic, chiefly basalt and volcanic tuffs. The surface, to a depth of about 7 feet, consists of irregular lava blocks embedded in whitish calcareous sand or mud. The horseshoe shape is no evidence of the island having been part of a crater-rim, but its present form is due to denudation and oscillations of level acting on an island built up of volcanic masses (which lie roughly horizontally) within a shallow coral-bearing sea.

AFRICA.

Opening of the Great Nile Dam.—The last stone of the great Nile dam at Assuan, one of the greatest works of the kind the world has ever seen, was laid by H.R.H. the Duchess of Connaught in December, an undertaking fraught with results of the greatest importance for the future prosperity of Egypt being thus brought to a successful conclusion. The whole work has been completed in little more than four years, the contract (which allowed five years for the execution of the work) having been entered into by Messrs. John Aird & Co. in February, 1898, while the first stone was laid by the Duke of Connaught on February 12, 1899. The magnitude of the task, and the energy displayed by the contractors in its execution, may be judged, however, by the fact that at times as many as 23,000 men were employed at once, either at the great dam itself or the subsidiary barrage at Assiut. Of these the greater number were Fellahin, who proved excellent workers, while of the remainder the bulk was composed of skilled Italian masons, whose numbers sometimes amounted to 2000. The history and prospective advantages of the undertaking are clearly sketched by Sir W. Willcocks—the engineer by whom the original plans were drawn up at the instance of Sir W. Garstin—in his work published in 1901, under the title, 'The Nile Reservoir Dam at Assuân and After,' which also gives plans and sections of the dam. Sir W. Willcocks points out the special features which give to the Nile dam a totally novel character, and which, in his opinion, will cause it to mark an epoch in dam-building, not only for irrigation purposes, but for the control of mighty rivers in flood with no less surety than they have hitherto been controlled at periods of low water. As built, the dam follows a straight line across the bed of the river at the first cataract, in the place of the curved line originally chosen by Sir W. Willcocks with a view to obtaining the soundest rock-foundation. Originally it was proposed that the height of the dam should be 100 feet above the zero of the Assuan gauge, but in deference to protests against the periodic submergence of the Philæ temple (though in Sir W. Willcocks' opinion this would cause no greater damage than the partial submergence which will now take place), the height was subsequently lowered by 26 feet. The storage capacity has thus been reduced from 85 to 35 milliards of cubic feet, though the dam is said to be strong enough to hold up 70 milliards, and it would be quite

possible to increase the height at a future date to 93 feet above the zero of the gauge. Even as made, the reservoir will contain over one thousand million tons of water, while, according to Sir Benjamin Baker, the volume of water issuing from it during the summer months, when the needs of the cultivators are greatest, will be equivalent to a river double the size of the Thames in mean annual flood condition. The results to be expected from the completion of the present scheme may be judged from the following facts. For the complete development of its 6,250,000 acres of cultivable land, three-fourths of which depend entirely on perennial (as opposed to basin) irrigation, Egypt has been shown to need 30,000 cubic feet of water per second of summer supply. Of this, in poor years, the Nile supplies only some 8000 cubic feet, leaving 22,000 to be supplied by reservoirs. A discharge of this amount for seventy-five days is reckoned as representing 150 milliards of cubic feet of water, 70 milliards of which, or about half, would be supplied by the Assuan reservoir if the height of the dam were raised. The new supply thus available for the three summer months would, therefore, be considerably greater than the ordinary discharge of the Nile in a poor year. The Assuan dam may be considered as the first step in a still vaster storage system, by which the whole needs of Egypt will ultimately be supplied, whether by the utilization of Lake Tsana or of the great Equatorial lakes.

The Du Bourg Expedition in East Africa.—In the *Journal* for August, 1902, we reproduced from *La Géographie* some particulars of the French Expedition under the Vicomte du Bourg de Bozas, which had traversed the Somali and Galla countries, and was then making its way west through the region between Lake Rudolf and the Nile. Dr. A. D. Milne writes to us from Nimule, a station of the Uganda Protectorate on the upper Nile, announcing the arrival of M. du Bourg's expedition at that place on September 9 last. It had left Adis Abbaba, on the second stage of the journey, on March 4, 1902, and proceeded, apparently by the valley of the Omo, towards the north end of Lake Rudolf, in the neighbourhood of which the routes of Dr. Donaldson Smith and Majors Austin and Bright were crossed. For the first half of the way the tribes were mainly hostile, but, by the exercise of tact, fighting was almost entirely avoided. On reaching the district of the Jalli, a section of the Langu, M. du Bourg was informed that there were "Turks" at Dufile, news of the re-occupation of the Nile province having therefore reached them. They also knew of Khartum and Mombasa, could speak the Nile Arabic, and wore cottons from Zanzibar. Dr. Milne suggests that they must be a remnant of Emin Pasha's mutineers, who were also encountered by the Macdonald Expedition. They live 170 miles west of Nimule. The scientific material obtained by the expedition includes a large number of zoological specimens, anthropological measurements, photographs, linguistic notes, etc. An important discovery of fossil remains was made on the right bank of the Omo. They were identified by Dr. Brumpt, the zoologist of the party, who found many large fish; two species of crocodile; two of elephant (one probably a good deal larger than the existing species, the other quite a pigmy, not more than a metre in height); three different species of *Equidæ*, probably zebra; many hippos; five kinds of pig; and eighteen specimens of antelope. Flint chippings, dating from pre-historic times, were also discovered. M. du Bourg is continuing his journey westward by the Congo route, and hopes to reach Paris by the beginning of April.

First Ascent of Mount Meru.—The great peak which rises from the Masai steppe to the west of Kilimanjaro was ascended in November, 1901, by Dr. Uhlig and Lieut. Schieritz, the former a meteorologist from Dar-es-Salaam, the latter, who has since succumbed to typhoid fever at that place, at the time the officer in charge of the German station at Great Arusha. Lieut. Schieritz's notes on the mountain,

together with reproductions of his photographs, which give an excellent idea of the physical character of Mount Meru, are printed in No. 6 of the last volume of *Globus* (vol. 82, 1902), accompanied by explanatory remarks by Herr Brix Förster. Meru was discovered by Rebmann in 1848, but though its imposing outline has impressed many travellers, few have actually reached its foot,* and only three original pictures of it appear to have been published. It is, as is well known, the second highest mountain in German East Africa, and the more restricted base from which it rises, and the consequently greater steepness of its side, make it, in some ways, a more striking object than Kilimanjaro. Lieut. Schieritz's photographs show the mountain as viewed from the north (from which side no picture had previously been taken), as well as from the south, south-east, and east, while another view shows the spur running out from the main mass to the north-west. The view from the east gives a good idea of the form of the crater, which, according to Lieut. Schieritz, is breached on the north-east, and here gives passage to streams strongly impregnated with natron. There is a smaller crater within the main one. The ascent was made from Great Arusha, through the district of Meru, the surface of which is composed of green hills—in part the spurs of the great mountain. Thence the way leads through the zone of forest, across a corner of the district of Ngongongara, until it emerges into more open country, from which a fine view of the crater is obtained. The forest zone is narrower than on Kilimanjaro, and the succeeding zone of bamboos, which embraces most of the foothills in the south (about 6500 feet), ceases where the actual peak of Meru is reached. The zone of tree-heaths, which has unfortunately been devastated by fire, reaches to about 13,000 feet, the highest point being estimated at about 15,700 feet. No trace of snow seems to have been met with, although the travellers are said to have reached a point about 15,400 feet above the sea. Herr Förster remarks that the volcanic character of the mountain was first recognized by von Höhnel, but this is scarcely correct, as Thomson, in 1885, spoke of it as the "wonderful volcanic cone of Meru" ('Through Masai-land,' p. 143).

The Geology of Cape Colony.—The Annual Report of the Cape of Good Hope Geological Commission for 1900 (Capetown, 1901) has just come to hand. The area surveyed mainly lay in the west of the High Veld in the divisions of Calvinia, Van Rhyns Dorp, and Clanwilliam. (1) *Ex Africa semper aliquid novi.* In Cape Colony, above the Namaqua schists, are the ancient Malmesbury beds of the south-west, and unconformably above these lies the Table mountain sandstone. A new series of beds of slates, sandstones, and conglomerates, differing in character from the Malmesbury beds, has been found overlying them and underneath the Table mountain sandstones in the Van Rhyn's Dorp division, and to them, temporarily at least, the name Ibiquas series has been given. Ripple-marks and animal tracks have been found in the Ibiquas sandstone, and these, with the solitary exception of a piece of quartzite with worm-tubes from the Table mountain sandstone, are the only fossil forms known in rocks older than the Bokkeveld beds which lie above the latter. The Ibiquas conglomerate, which contains granite boulders, may be contemporaneous with the Cango conglomerate, but Dr. Corstorphine urges caution in generalizing about South African geology. (2) A glacial deposit has been found interbedded in the Table mountain sandstone at Pakhuis pass, and the director has no hesitation in adopting his assistants' conclusion that the glacially marked stones have been deposited contemporaneously in these sandstones, and so are probably of early Devonian age, and not a portion of the Dwyka

* The first attempted ascent was that of Teleki and von Höhnel in 1887, but these travellers only reached an altitude of 4900 feet on the south-eastern foot-hills.

conglomerate folded into an anomalous position. The elevation of the Malmesbury beds probably formed the land whose denudation produced the material for the Table mountain quartzite, and from this land surface the ice-scratched stones may have been carried. "The fact is noteworthy that glacial action should have played a conspicuous part on each of the two most ancient land areas" revealed at the Cape. (3) The change from the southern conformity to the northern unconformity, beneath the Dwyka conglomerate (see *Geographical Journal*, December, 1902, p. 631), has been traced northwards from the Ceres division, although, owing to difficulties of transport, the actual spot where the uncomformity begins was not visited. (4) In the area surveyed, unlike the region farther south, basic dykes and sheets have been exposed in nearly all the older series, and are of the same type as those intrusive in the younger rocks of the Central Karroo.

Decline of Mozambique.—The serious condition of Mozambique, especially so far as regards its commerce, is alluded to at considerable length in the recently published consular report. In the island of Mozambique itself great stagnation prevails, and signs of commercial decay are everywhere manifest. The exports of last year are little more than one-third of those of the preceding year; two of the most important European trading houses have withdrawn, and even the British Indian merchants find it almost impossible to exist. The causes of this decadence are said to be various, but foremost among them is the disturbed condition of the country, which is absolutely closed to commerce inland, even to within a distance of 10 miles of the coast. There has lately been a considerably diminished rainfall, and the resultant drought has caused widespread famine on the mainland. Moreover, the country has been visited several times by immense flights of locusts, which have done incalculable damage to the cereals and the palms. Firm repression of the rebels in the interior, and a more liberal customs tariff, which at present weighs heavily on the trader, are, it is insisted, absolutely necessary before Mozambique can hope to regain her prosperity.

Climate of the Seychelles.—From the recent report on the Seychelles islands, issued by the Colonial Office, it appears that the year 1901 was distinctly cooler throughout than the preceding year. A mean temperature of 78·48 was noted, as against 79·58 in 1900, and a minimum of 68·4 was recorded—a temperature apparently lower than any recorded in the past six years. The coolest, driest, and healthiest months are from June to October. February is the wettest month, with a rainfall last year of 16 inches; August the driest, with 1·33 inch. The total rainfall amounted to 102·26 inches; it fell on 162 days. July, August, and September show the highest record for wind, the average force being from 9·5 to 14·2 miles per hour; but the islands are all situated outside the hurricane region.

AMERICA.

The Lowlands of South-Eastern Missouri.—The physical history of the lowlands which occupy the south-east corner of the state of Missouri has attracted a good deal of attention, owing to the difficulty which has been felt in accounting for their origin. The fact that the topographical features of the district have never been thoroughly mapped has hitherto made it difficult to obtain the accurate basis of fact on which to build a satisfactory explanation, and such suggestions as have been made have been largely of the nature of guesses. Prof. Marbut, of the Missouri Geological Survey, has for some time devoted his attention to the subject, and has, with the help of assistants, made a careful study of the ground, which has enabled him to offer a detailed explanation of the whole history of the phenomena (*University of Missouri Studies*, vol. i. No. 3, 1902). In the first part of the paper he carefully describes the present surface features and geology of the region, which

consists of belts of lowland, enclosing belts and isolated areas of upland, sloping steeply to the flat-lands which surround them. The peculiarity of the lowlands is that they are not followed continuously by any stream, or even crossed by streams large enough to be considered the cause of their origin. From the first settlement of the region the inhabitants have been struck by these facts, and have sought to account for the lowland belts either as old valleys of the Mississippi, or as due to a sinking of the ground during the earthquakes of 1811 and 1812. Of scientific observers Dr. Branner had accepted the popular view which attributed them to the action of the Mississippi, but without showing how this was exercised; while Mr. Call placed the erosion of one of the principal belts of lowland in Tertiary times, before the deposition of the Tertiary sands and gravels and of the loess of this region. This is shown by Mr. Marbut's examination of the country to be quite untenable, the loess, gravel, sand, and clay having been all alike cut by the force which eroded the lowland. A previous explanation of his own, according to which the main lowland belt lay along the border between an old coastal plain on the one hand and the Palæozoic highlands on the other, the principal ridge being regarded as a *cuesta*, is equally untenable. In putting forward his present explanation, Mr. Marbut shows that the lowlands have been formed neither by subsequent erosion on the part of small tributaries of the larger streams, nor by subsidence between faults, and that the only explanation left is that they were eroded by rivers and creeks which have since abandoned their valleys, positive evidence for which view is, he holds, abundant and conclusive. All the formations except the alluvium having been eroded by the streams to whose action the lowlands are due, the latter are shown to be younger than the loess. The valleys were eroded much deeper than at present, and afterwards filled by the deposition of alluvium, probably during the second glacial epoch. The two main lowlands are shown to have been eroded by the Mississippi and Ohio respectively, the bluffs of each being continuous with those of the respective river-valleys above where they occur. The various stages of river-capture by which the Mississippi has twice been diverted from its former course, so as to invade the original valley of the Ohio, are clearly traced by the writer who points out also the pre-existing conditions which favoured such diversion. Lesser river-captures have also taken place, and in this way the formation of the minor lowlands can likewise be explained. The study is fully illustrated by maps, and forms an excellent illustration of the action of processes by which existing surface features are brought about.

The Caribs of Dominica.—A special Report on the Caribs has lately been furnished to the Colonial Office by Mr. H. Hesketh Bell, the administrator of Dominica island. It gives an outline of the history of these people who, in the time of Columbus, were found in possession of the smaller islands from St. Thomas to Tobago, while the mild and timid Arawaks inhabited Cuba, San Domingo, Jamaica, and the other large islands. The Caribs could not have been long in the Archipelago before the advent of the Europeans, for their settlements were still small and scattered. Their chief strongholds were Trinidad, Santa Cruz, Guadeloupe, Martinique, and Dominica, and in the beginning of the seventeenth century they remained masters of the latter three only, the English, French, and Spanish alike carrying on a war of extermination against them. During a great part of the seventeenth century, their raids and incursions were of almost annual occurrence, and were, moreover, usually successful, even the governors being on more than one occasion carried off or murdered. In 1748 Dominica was set apart as a neutral island for the Caribs, but it did not long remain so, for fifteen years later it was definitely assigned to the British, and the small area of 232 acres allotted as a Carib reserve. In 1791 these people were reported to consist of not more than twenty or thirty families,

and their taste for human flesh had probably disappeared. Their numbers have since apparently undergone no alteration, about four hundred claiming to be Caribs in the reserve. Of these, however, Mr. Bell thinks that not more than a hundred and twenty are of pure blood. They are undoubtedly the last survivors of their race in the West Indies, for the so-called Caribs of St. Vincent are much more akin to Negroes, miscegenation between Negro and Carib having occurred centuries ago on that island where, so far back as 1700, they were known as "Black Caribs" in contradistinction to the "Red Caribs" of Dominica and Guadeloupe. Mr. Bell says, curiously enough, that "the Carib type, even in the remnant which survives to-day, shows an unmistakably Mongolian character, and it would be hard to distinguish a Carib infant from a Chinese or Tartar child." The children have extremely bright and intelligent expressions, and show considerable ability. The hair is described as being very straight, rather coarse, and of a beautiful blue-black colour; the complexion varied from brown to pinkish-yellow. The Carib language is practically extinct. Mr. Bell says, with regard to the pronunciation of the name, that the people themselves all pronounce it as if spelt "Cribe," rhyming with scribe. The Caribs are still famous for their canoes and their waterproof baskets. They are great fishermen, but do not cure their surplus. Simple agriculture is undertaken, and some of them possess a few cattle or sheep. They are exempt from direct taxation, but are required to keep in order the 2 miles of high-road which traverse their reserve. It is suggested that a larger area and some better land should be granted to them. The race is apparently being merged into the Negroes, mixed marriages being very common, and it is feared that in a few decades there will not be a single pure-bred Carib left.

AUSTRALASIA.

Visit to Stuart's Tree, Northern Territory of Australia.—When, in July, 1862, the explorer Stuart reached the shores of the northern sea after his successful crossing of the Australian continent, he signalized the accomplishment of his great undertaking by having his initials (J.M.D.S.) cut in a large tree in a valley some 3 miles from the coast, whilst he also hoisted the Union Jack on one of the tallest trees by the sea-shore, and buried a tin case with the record of his journey one foot south from its base. This record has never since been discovered, but the tree with the explorer's initials was found in 1883 by a party sent by the Acting Government Resident, Mr. G. R. McMinn. It was a species of Albizzia (one of the *Mimoseæ* sub-order of *Leguminosæ*), about 3 feet 6 inches in diameter. The letters were about 2 feet in length, cut very deep, and were then almost as perfect as when formed. In 1893, when visited by the present Government Resident, Mr. Justice Dashwood, and others, it was found that a great piece had been cut out of the tree beneath the inscription, and this seems to have caused decay, which has led to the death of the tree. An expedition to the neighbourhood, on Chambers bay, was lately organized by Mr. Dashwood, and some particulars of this were given in the *Adelaide Observer* for November 1 last. On arriving at the spot where the canister was supposed to have been buried, the shore was found to be encumbered with fallen trees, some half-embedded in slimy ooze, giving the impression that the sea is gaining on the land, in which case the tin and its contents must long since have been destroyed. The party next made for the site of the inscribed tree, only to find a heap of white ashes, apparently not many weeks old, the tree having been almost entirely consumed by fire. It had evidently been dead for some time, and had fallen before being set on fire. The spot was marked by a stake, and bearings taken from other trees with a view to the future erection of a more permanent monument.

POLAR REGIONS.

French Expedition to Northern Spitsbergen in 1693.—In the *Bulletin de Géographie Historique et Descriptive* for 1901 (No. 1, p. 32), Dr. Hamy pieces together from contemporary documents an account of a cruise to the north of Spitsbergen in 1693 by four French frigates during the war between Louis XIV. and the "Grand Alliance." It was undertaken with a view to inflicting as much damage as possible on the Dutch whaling fleet in northern waters, this nation then holding a virtual monopoly of the Spitsbergen whale fishery, in spite of the vigorous efforts put forward earlier in the century by a French company—for a time with success—to obtain a share in the profits. The four frigates were under the command of La Varenne, who had under him a number of experienced Basque officers, including the daring seaman known by the sobriquet "Coursic," or the Little Corsair, while the celebrated Gouin de Beauchene (or Beauchesne Gouin) was captain of one of the ships. The expedition arrived at Magdalena bay, on the north-west coast of Spitsbergen, on July 29, and soon afterwards the first Dutch ships were seen. The records throw an interesting light on the activity of the Dutch whalers in those days, no fewer than fifty ships being met with among the ice to the north-east. They retreated to Bear bay, but were attacked and overpowered in spite of a gallant defence, twenty-eight ships in all falling into the hands of the French. Dr. Hamy reproduces a contemporary chart of the north coast of Spitsbergen, which shows the various bays with a near approach to accuracy, and explains the situation of the rival squadrons during the course of the operations.

Captain Amundsen's Expedition to the North Magnetic Pole.—In the *Geographical Journal*, vol. xx. p. 629, lines 17 and 18, the nautical miles are Norwegian, and as intimated at the beginning of the article should be multiplied by 4 to convert into English nautical miles, making the figures 160 and 120 respectively.

GENERAL.

Geography at Cambridge.—A step which may lead to valuable results in the direction of improving the scientific training of our travellers, has been taken at Cambridge by the Reader in Geography and the University Lecturers in Ethnology and Geology. A course of lectures and practical instruction has been arranged for the Lent Term of 1903, and will be open to members of the University and others who may wish to undertake exploration, or who, during residence or travel in foreign countries, may desire to contribute to our knowledge about them. In addition to lectores by Mr. Oldham, Dr. Haddon, and Mr. Marr on the various branches of geography, ethnology, and geomorphology, the methods of survey will be dealt with by Mr. Garwood and Mr. Hicks. The fee for the whole course will be three guineas, and further information may be obtained from Dr. Haddon, Inisfail, Hills Road, Cambridge, either by letter or by calling at the Museum of Archæology and Ethnology between 10 and 1 o'clock on January 16 or 17.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1902–1903.

First Ordinary Meeting, November 12, 1902.—Sir CLEMENTS MARKHAM, K.C.B., F.R.S., President, in the Chair.

The Papers read were:—

1. The President's Address.
2. "World-shaking Earthquakes." By Prof. John Milne, F.R.S.

Second Ordinary Meeting, November 24, 1902.—Sir CLEMENTS MARKHAM, K.C.B., F.R.S., President, in the Chair.

ELECTIONS.—*Frank Adam; William Acton-Adams; Raymond Cecil Allen; Eugene André; John F. Baddeley; Captain Ernald Barnardiston, R.E.; Conrad Clair Biedermann; Francis Bradley Bradley-Birt, Indian Civil Service; David Mather Bowie; George Melville Boynton; Henry Bradford; J. F. Braham; John Bredall; Dr. William Albert Briggs; F. D. Willoughby Bullock; Major J. Alder Burdon, 1st Class Resident, Northern Nigeria; Alan H. Burgoyne; Rev. Chas. George Stratford Burn, M.A.; James F. Cadenhead; Joseph Clark; Major J. L. J. Clarke, East Yorkshire Regt.; Major Stephenson R. Clark, 3rd Batt. Royal Sussex Regiment; Haggitt Colbeck; Harold Cookson; Lieut. E. W. Cox, R.E.; Clarence Craig; Captain Ettrick W. Creak, R.N., C.B., F.R.S.; Herbert H. Crease; Lieut. A. A. Crookshank, R.E.; Captain H. L. Crosthwait, R.E.; Rev. J. N. Cushing; Major Wm. Cooke Daniels, U.S. Army; Richard Stanley Davies; Joseph Burtt Davy; Captain B. Dickson, R.A.; William Byron Drury, Egyptian Army; Captain Cyril Hammond Elgee, 1st Beds. Regiment; Sir Charles N. E. Eliot, K.C.M.G., C.B., His Majesty's Commissioner & Consul-General B.E.A. Protectorate; W. A. Evans; Herbert Charles Fanshawe, late Bengal Civil Service; Dr. Filippo de Filippi; Lieut. Angus Cadden Fletcher, R.A.M.C.; Edmund Forbes; W. A. Freymuth; Captain E. C. L. Fitzwilliams, Army Service Corps; Geo. Reginald Gill; T. Lennox Gilmour, Barrister-at-Law; Captain Fras. Herbert Goldthorp, 3rd Punjab Cavalry; Walton Howorth Greenly, D.S.O., Brigade-Major 12th Royal Lancers; Wm. John Greenstreet, M.A., F.R.A.S.; Wm. Fredk. Hamilton, K.C., LL.D.; Captain Hy. Evered Haymes, R.A.M.C.; Baron Hindlip; Lieut. H. A. Holdich, 5th Gurkha Rifles; Masao Hori; Captain C. G. W. Hunter, R.E.; Geo. Thompson Hutchinson; Robert Robertson Hynd; T. Hall Imrie; John Henry Jacoby; Richard Ll. Jones; Geo. Henry Judd; Joseph Hy. Thomas Keeves; Arvid Ludwig Kellgren, Surgeon, M.D.; Major Fredk. Weston Peile Macdonald, I.S.C.; Peter Joseph MacLeod, B.A.; Theodor Gustav Meissner; Robert Miller; G. H. Milward; Arthur John Charles Molyneux, F.G.S.; Captain Herbert Acheson Moore, South Wales Borderers; Edward A. J. Mulock, Sub-Lieut. R.N.; Henry O'Sullivan; Captain Wm. McMullen Pearson, Indian Medical Service; George Pepper; Major George Pereira, D.S.O., Grenadier Guards; Charles Curteis Philpott; Sydney J. Porter; Wm. Thos. Price; Ernest Protheroe; Reginald Rankin; Walter Redman; William Sheldon Ridge, B.A.; Captain C. L. Robertson, R.E.; William Henry Robinson; Norman Scott Rudolf, M.Sc.; William Rudolf; David Alexander Ruffmann; Charles Herbert Sankey; Frederick A. Saunders, M.D.; Captain Frank R. Sedgwick, R.F.A.; Henry John Selby; H. Redfearn Shaw; Franklin A. Snow, C.E.; Captain James Johnston-Stewart, 2nd Batt. King's African Rifles; Frederic Spence Tatham; Lieut. Frank Robinson Teesdale,*

5th Punjab Cavalry; E. Timperlake, F.R.H.S.; John Forward Toogood; Reginald Tower, His Majesty's Minister at Bangkok; A. John Lyttleton Turner; John H. Udny; F. J. Varley, M.A.; Hans Vischer, C.M.S.; Charles H. Stuart Wade, J.P.; Major F. W. G. Wadeson, 5th Bengal Cavalry; H. Boyd Wallis; Anton F. Wilcken; Sir Andrew Wingate, K.C.I.E.; John Greaves Wiseman, F.R.C.S. Eng.; Harry Forbes Witherby; Captain P. R. Wood, Royal Irish Fusiliers; William Arden Wood, M.A.; John T. Wood, M.A.; Rev. Frederick George Wright, Chaplain to the Forces; Alfred Ernest Young.

The Paper read was :—

"Exploration in Western China." By Captain C. H. D. Ryder, R.E.

Third Ordinary Meeting, December 8, 1902.—Sir CLEMENTS MARKHAM, K.C.B., F.R.S., President, in the Chair.

ELECTIONS:—*Lieut. Joseph Bennett-Yates, R.N.R.; Captain G. A. S. Cape, R.A.; Lieut. Hazeldean Forsyth, R.E.; Alfred Arkell-Hardwick; K. D. Harrison; Lieut.-Col. W. B. Hickie, 7th Royal Fusiliers; Frederick Julius Macaulay; Brevet-Major F. W. Moffitt, Essex Regiment; Sir Francis I. O'Callaghan, K.C.M.G., C.S.I., C.I.E.; Captain Thos. Terence Constantine Purland, J.P.; Colonel Dixie Henry Robertson; Commander Arthur Hayes-Sadler, R.N.; Edward John Scott; Major G. S. Sewell de Gana; Lieut. Cecil Minet Staveley, R.N.; Alexander William Thorne.*

The Paper read was :—

"Three Years' Exploring Work in Central Asia." By Dr. Sven Hedin.

Fourth Ordinary Meeting, December 15, 1902.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

The Paper read was :—

"Explorations in North-West Mexico." By Dr. Carl Lumholtz.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full :—

A. = Academy, Academie, Akademie.
Abh = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. *Quarterly J. Geolog. S.* **58** (1902): 690-702. **Bonney.**

Alpine Valleys in Relation to Glaciers. By Prof. T. G. Bonney, D.SC. *With Sections.*

Central Europe. **Drude.**

Die Vegetation der Erde. Sammlung pflanzen-geographischer Monographien herausgegeben von A. Engler und O. Drude. VI. Der Hercynische Florenbezirk. Grundzüge der Pflanzenverbreitung im mitteldeutschen Berg- und Hügellande vom Harz bis zur Rhön, bis zur Lausitz und dem Böhmer Walde. Von Dr. Oscar Drude. Leipzig: W. Engelmann, 1902. Size 10½ × 7, pp. xx. and 672. *Map and Illustrations.*

France—Vosges. **Boyé.**

Les Hautes-Chaumes des Vosges. Étude de Géographie et d'Économie historiques. Par Pierre Boyé. Paris: Berger-Levrault & Cie., 1903 [1902]. Size 9 × 5½, pp. 432. *Plates. Price* 6 *fr. Presented by the Publishers.*

France—Waterways. ——

1[er] Congrès du Sud-Ouest Navigable tenu à Bordeaux les 12, 13 et 14 Juin 1902. Compte rendu des Travaux. Bordeaux: Feret et Fils, 1902. Size 10 × 6½, pp. 478. *Map. Presented by the Publishers.*

France—West Coast. *B.G. Historique et Descriptive* (1901): 313-341. **Pawlowski.**

Le Golfe du Poitou à travers les Âges, d'après la géologie, la cartographie et l'histoire. Par M. Auguste Pawlowski. *Map.*

Germany—Geodesy. **Marcuse.**

Centralbureau der Internationalen Erdmessung. Neue Folge der Veröffentlichungen, No. 6. Ergebnisse der Polhöhenbestimmungen in Berlin ausgeführt in den Jahren 1889, 1890 und 1891 am Universal-Transit der Königlichen Sternwarte von Dr. Adolf Marcuse. Berlin: G. Reimer, 1902. Size 11½ × 9, pp. 30.

Germany—Harz—Lakes. *M.V. Erdk. Halle* (1902): 94-96. **Halbfass.**

Ueber Einsturzbecken am Südrand des Harzes. Vorläufige Bemerkungen von Prof. Dr. W. Halbfass.

Germany—Plant-geography. *M.V. Erdk. Halle* (1902): 14-70. **Schulz.**

Studien über die phanerogame Flora und Pflanzendecke des Saalebezirkes. I. Die Wanderungen der Phanerogamen im Saalebezirke seit dem Ausgange der letzten kalten Periode. Von Dr. A. Schulz. *With Map.*

Germany—Prussia—Magdeburg. *M.V. Erdk. Halle* (1902): 70-94. **Quitzow.**

Die Wische, insbesondere deren Bodenbau und Bewässerung. Von Dr. W. Quitzow. *With Map.*

Germany—Thuringia. *M.V. Erdk. Halle* (1902): 8-9. **Henkel.**

Karsterscheinungen im thüringischen Muschelkalk. Von Dr. L. Henkel. *With Sketch-map.*

Germany—Thuringia. *Vierteljahrshefte G. Unterricht* **2** (1903): 27-32. **Kollbach.**

Bilder aus dem Thüringerwald. Von Karl Kollbach.

Greece and Turkey. *Sitzb. K.A.W. Wien.* 110 (1901), (Abth. I.): 171-182. **Hilber.**

Geologischer Reisen in Nordgreichenland und Makedonien 1899 und 1900 (vorläufiger Bericht). Von Vincenz Hilber.

Holland. *Rev. G.* **26** (1902): 266-275. **Bellet.**

Le dessèchement du Zuiderzee. Par Daniel Bellet.

Holland. *Tijds. K. Ned. Aard. Genoots. Amsterdam* **19** (1902): 909-935. **Beekman.**

Nomina Geographica Neerlandica uit een geographisch oogpunt beschouwd. Door A. A. Beekman.

Discusses various geographical terms.

Holland. **Blink.**
Tijds. K. Ned. Aard. Genoots. Amsterdam **18** (1901): 731–767; **19** (1902): 59–107, 481–514, 936–958.

Studien over nederzettingen in Nederland. Door Dr. H. Blink. *With Maps.*
See note in the Monthly Record (*ante*, p. 75).

Iceland. **Bisiker.**
Across Iceland. By W. Bisiker With an appendix, by A. W. Hill, on the plants collected. London: Edward Arnold, 1902. Size 9 × 6, pp. xii. and 236. *Maps and Illustrations. Price 12s. 6d. Presented by the Publishers.*
This will be reviewed elsewhere.

Iceland. *J. of T. Victoria I.* **34** (1902): 164–181. **Stefansson.**
Iceland: its History and Inhabitants. By Herr Jon Stefansson, PH.D.

Italy **Baedeker.**
Italy. Handbook for Travellers. By Karl Baedeker. First Part. Northern Italy, including Leghorn, Florence, Ravenna, and routes through Switzerland and Austria. Twelfth remodelled edition. Leipsic: K Baedeker, 1903. Size 6½ × 4, pp. lxiv. and 564. *Maps and Plans. Price 8m. Presented by the Editor.*

Italy—Modena. **Corti.**
Le Provincie d'Italia sotto l'aspetto geografico e storico descritte da Siro Corti. N. 63. Regione Emiliana. Provincia di Modena. Torino, etc.: G. B. Paravia e Comp., 1895. Size 8 × 5, pp. 56 *Maps and Illustrations. Price 6d.*

Montenegro. *Blackwood's Mag.* **172** (1902): 303–318. **Wyon.**
Montenegrin Sketches. By Reginald Wyon.

Norway—Fjords. *J. of T. Victoria I.* **34** (1902): 125–151. **Hull.**
The Physical History of the Norwegian Fjords. By Prof. Edward Hull. *With Map and Illustrations.*

Pyrenees. **Scharff.**
Ueber den Einfluss der Pyrenäen auf die Tierwanderungen zwischen Frankreich und Spanien. Von Dr. R. F. Scharff. (Sonderabdruck aus den Verhandlungen des V. Internationalen Zoologen-Congresses zu Berlin, 1901.) Jena: Gustav Fischer, 1902. Size 9½ × 6½, pp. 5. *Presented by the Author.*

Russia—Crimea. *C. Rd.* **135** (1902): 355–356. **Daniloff.**
Sur la géographie physique de la Yaïla occidentale (Crimée). Note de E. Daniloff.

Servia. *Deutsche Rundschau G.* **24** (1902): 407–415, 461–465, 532–542. **Meinhard.**
Durch Serbien. Von Friedrich Meinhard.

Sweden—Geology. **Holst.**
Bidrag till Kännedomen om Östersjöns och Bottniska Vikens postglaciala geologi. Af Nils Olof Holst. (Sveriges Geologiska Undersökning. Ser. C, No. 180.) Stockholm: P. A. Norstedt & Söner, 1899. Size 9 × 6, pp. 128. *Map. Presented by the Swedish Geological Survey.*

Sweden—Geology. ——
Upplysningar till geologisk Öfversikts-karta öfver Sveriges berggrund, upprättad och utgifven af Sveriges Geologiska Undersökning ar 1901, mit einem Resumé in Deutscher Sprache. (Sveriges Geologiska Undersökning. Ser. Ba. No. 6.) Stockholm: P. A. Norstedt & Söner, 1901. Size 9½ × 6½, pp. 62. *Presented by the Swedish Geological Survey.*

Switzerland—Lake of Zurich. **Lozeron.**
Vierteljahrs. Naturforsch. Ges. Zürich **47** (1902): 115–198.
Sur la répartition verticale du plancton dans le lac de Zurich, de décembre 1900 à décembre 1901. Par H. Lozeron. *With Diagrams.*

Switzerland—Rigi. *Globus* **82** (1902): 110–111. **Friedrich.**
Karte des Rigi. Ein Beitrag zur Terraindarstellung. Von Dr. Ernst Friedrich. *With Map.*

United Kingdom. ——
The Climates and Baths of Great Britain, being the Report of a Committee of the Royal Medical and Chirurgical Society of London. Vol. i. The Climates of the South of England and the chief Medicinal Springs of Great Britain. Vol. ii. The Climates of London and of the Central and Northern portions of

England, together with those of Wales and of Ireland. London: Macmillan & Co., 1895–1902. Size 9½ × 6, pp. (vol. i.) xvi. and 640; (vol. ii.) xvi. and 628. *Maps and Diagrams. Price 12s. 6d. each volume.*

These will be specially reviewed.

United Kingdom—England. *G. Teacher* 1 (1902): 150-166. **Herbertson.**

On the One-Inch Ordnance Survey-Map, with special reference to the Oxford Sheet. By A. J. Herbertson, PH.D. *With Maps and Illustrations.*

United Kingdom—England. **Windle.**

Shakespeare's Country. By Bertram C. A. Windle. Illustrated by Edmund H. New. London: Methuen & Co., 1901. Size 6 × 4, pp. xii. and 220. *Map and Illustrations. Price 3s. Presented by the Publisher.*

United Kingdom—England—Cambridge. **Thompson.**

Cambridge and Its Colleges. By A. Hamilton Thompson. Illustrated by Edmund H. New. London: Methuen & Co., 1898. Size 6 × 4, pp. xvi. and 316. *Plan and Illustrations. Price 3s. Presented by the Publishers.*

United Kingdom—England—London. *J.R. Statistical S.* 65 (1902): 447–502. **Welton.**

A Study of some portions of the Census of London for 1901. By T. A. Welton.

United Kingdom—England—Malvern. **Windle.**

The Malvern Country. By Bertram C. A. Windle. Illustrated by Edmund H. New. London. Methuen & Co., 1901. Size 6 × 4, pp. xii. and 236. *Plan and Illustrations. Price 3s. Presented by the Publishers.*

United Kingdom—England—Oxford. **Wells.**

Oxford and Its Colleges. By J. Wells, M.A. Illustrated by Edmund H. New. London: Methuen & Co., 19—. Size 6 × 4, pp. xii. and 330. *Plan and Illustrations. Price 3s. Presented by the Publishers.*

United Kingdom—England—Stonehenge. **Hunter.**
Nineteenth Century 52 (1902): 430-438.

The Inclosure of Stonehenge. By Sir Robert Hunter. *With Map.*

United Kingdom—Ireland. *Geolog. Mag.* 9 (1902): 456–458. **Cole**

On the Geological Structure of Ireland. By Prof. Grenville A. J. Cole.

United Kingdom—Ireland. ———

Department of Agriculture and Technical Instruction for Ireland. Ireland, Industrial and Agricultural. Dublin, etc.: Browne & Nolan, Ltd., 1902. Size 10 × 7, pp. 532. *Maps and Illustrations. Price 5s. net.*

A most useful summary of the economic facts relating to Ireland, consisting of a number of articles by experts on the several subjects.

United Kingdom—Rainfall. **Wallis and Mill.**

British Rainfall, 1901. On the Distribution of Rain over the British Isles during the year 1901, as observed at about 3500 stations in Great Britain and Ireland, with Articles upon various branches of Rainfall work. Compiled by H. Sowerby Wallis and Hugh Robert Mill. London: E. Stanford, 1902. Size 8½ × 5½, pp. 60 and 252. *Maps and Diagrams.*

A special article deals with rainfall averages in the British Isles for a series of years.

United Kingdom—Scotland—Hebrides. **Goodrich-Freer.**

The Outer Isles. By A. Goodrich-Freer. Westminster: A. Constable & Co., 1902. Size 9 × 5½, pp. xvi and 448. *Map and Illustrations. Price 12s. 6d. net. Presented by the Publishers.*

ASIA.

Arabia. *J.R. United Service I.* 46 (1902): 1419–1435. **Wachs.**

The Present and Future of Arabia. By Major Otto Wachs. (Translated from the "Marine-Rundschau," January, 1902.)

Central Asia. **Roborovsky.**

Results of the Expedition of the Imperial Russian Geographical Society in Central Asia carried out in 1893–1895, under the command of V. N. Roborovsky. Part ii. [In Russian.] St. Petersburg, 1899. Size 12 × 8½, pp. viii. and 296. *Map and Plates*

China. **Birch.**

Travels in North and Central China. By John Grant Birch. London: Hurst & Blackett, Ltd., 1902. Size 9 × 5½, pp. xvi. and 380. *Illustrations. Price* 10*s.* 6*d. net. Presented by the Publishers.* [Review, p. 64.]

China. **Nichols.**

Through Hidden Shensi. By Francis H. Nichols. London: George Newnes, Ltd., 1902. Size 9 × 6, pp. xxxii. and 334. *Map and Illustrations. Price* 12*s.* 6*d. net. Presented by the Publishers.*

China—Kiau-chou. *Rev. Française* 27 (1902): 646–654. **Servigny.**

Le développement de Kiao-Tchéou. Par J. Servigny. *With Map.*

China—Kwangsi. *Rev. Colon.* (1902): 627–646. **François.**

Notice sur le Kouang-Si. Par le lieutenant F. François.
Itineraire dans le Kouang-Si. By the same.

Chinese Empire—Gobi Desert. **Futterer.**

Geographische Skizze der Wüste Gobi zwischen Hami und Su-tschôu. Von Prof. Dr. K. Futterer. (*Petermanns Mitteilungen*, Ergänzungsheft Nr. 139.) Gotha: Justus Perthes, 1902. Size 12 × 7½, pp. 36. *Map. Price* 3 *m.* 20 *pf.*

Japan. **Haas.**

Geschichte des Christentums in Japan. Von Pfarrer Hans Haas. 1. Erste Einführung des Christentums in Japan durch Franz Xavier. (Supplement der "Mittheilungen" der Deutschen Gesellschaft für Natur- und Völkerkunde Ostasiens.) Tokyo, 1902. Size 9½ × 6½, pp. xiv. and 300. *Portrait.*

This work promises to be, when complete, a valuable addition to our knowledge of European dealings with Japan. The first three chapters give an outline of the early knowledge of Japan current in Europe, and of the first voyages of the Portuguese to the island kingdom.

Korea. *Globus* 82 (1902): 158–161. **Magnus.**

Ein Besuch am Hofe von Korea. Von Friedrich Magnus. *With Illustrations.*

Malay States—Perak. **Rodger.**

Perak Administration Report for the year 1901. By J. P. Rodger. Taiping, Perak. N.D. Size 13 × 8½, pp. 52.

Persia. *J.R. Asiatic S.* (1902): 939–949. **Sykes.**

Historical Notes on South-East Persia. By Major P. Molesworth Sykes, C.M.G. *With Map and Illustrations.*

Persia. *P.R. Artillery I.* 29 (1902): 147–154. **Wyatt.**

The Western Glacis of India. By Captain F. O. Wyatt. *With Map.*

The previous portions of this paper appeared in the same *Journal* during 1900 and 1901.

Russia—Sakhalin. *Tour du Monde*, 8 (1902): 409–480. **Labbé.**

Une Bagne Russe. L'Ile de Sakhaline. Par M. Paul Labbé. *Map and Illustr.*

Russia—Siberia. **Zepelin.**

Das russische Kustengebiet in Ostasien. (Primorskaja Oblastj.) Von C. von Zepelin. Berlin: G. S. Mittler & Son, 1902. Size 9½ × 7, pp. 60. *Maps and Plan. Presented by the Publishers.*

Russia—Siberia. **Ruffmann.**

Across Siberia by Rail. A Trip to the Amur Goldfields. By David A. Ruffmann. (Reprinted from the *Pall Mall Gazette.*) 1902. Size 8½ × 5½, pp. 34. *Presented by the Author.*

Contains some information on mining in Siberia, of the prospects of which the writer takes a sanguine view.

Russia—Siberia. *Rev. G.* 26 (1902): 240–265. **Barré.**

Le peuplement et la Colonisation de la Sibérie. Par Paul Barré.

Russia—Siberia. *Questions Dipl. et Colon.* 14 (1902): 276–287. **Labbé.**

La Transbaïkalie et la colonisation russe. Par Paul Labbé.

Siam. *Fortnightly Rev.* 72 (1902): 551–559. ——

Siam and the Powers. By X. Y. Z. *With Map.*

Written before the conclusion of the recent Franco-Siamese agreement. The map omits a portion of the French sphere of action in Northern Siam.

Singapore—Historical. **Van der Kemp.**
Bijd. Taal-, Land- en Volkenk. Ned.-Indië **10** (1902): 313–476.
De stichting van Singapore, de afstand orvan met Malakka door Nederland, en de Britsche aanspraken op den Linga-Riouw Archipel. Door P. H. van der Kemp.

On events connected with the founding of Singapore in the early part of the nineteenth century.

Syria and Palestine. **Paton**
The Semitic Series.—The Early History of Syria and Palestine. By Lewis Bayles Paton. London: John C. Nimmo, 1902. Size 8 × 5, pp. xxxvi. and 302. *Maps. Presented by the Publishers.*

Tibet. *Petermanns M* **48** (1902): 137–138, 163–165, 184–187. **Krahmer**
Nachrichten von der Expedition von P. K. Koslow Von General Krahmer. *With Map.*

Turkey—Palestine. *B.S G. Genève* **41** (1902): 128–144. **Gautier**
Le lac de Tiberiade Par M le Prof. Lucien Gautier. *With Illustrations.*

Turkey—Palestine. **Macalister.**
Palestine Exploration Fund, Q. Statement (1902): 317–364.
First Quarterly Report of the Excavation of Gezer. By R. A. Stewart Macalister. *With Plan and Illustrations.*

AFRICA.

Abyssinia. **Berkeley.**
The Campaign of Adowa and the Rise of Menelik. By G. F. H. Berkeley. Westminster: A. Constable & Co., 1902. Size 9 × 6, pp. xiv. and 401. *Maps. Price 7s. 6d. net. Presented by the Publisher.*

Abyssinia—Gallas. **Salviac.**
P. Martial de Salviac. Un Peuple Antique au Pays de Menelik. Les Galla. (Dits d'Origine Gauloise), Grand Nation Africaine. Paris: H. Oudin [not dated]. Size 11 × 7½, pp. viii. and 354. *Map and Illustrations. Price 7s.*

A very complete study of the Gallas from the point of view of history, manners and customs, institutions, etc.

Abyssinia—History. **Arab-Faqih and Basset.**
Publications de l'école des Lettres d'Alger. Histoire de la Conquête de l'Abyssinie (XVIe Siècle). Par Chihab Ed-Din Ahmed Ben 'Abd El-Qâder surnommé Arab-Faqih. Traduction Française et Notes par René Basset. Paris: E. Leroux, 1897–1901. Size 10 × 6½, pp. 506. *Price 1s.*

A new translation of the well-known history of the conquests of Mohamed Granye, with valuable critical and explanatory notes. The Arabic text is also published in the same series.

Africa—Bibliography. ——
Catalogue of an extensive collection of books, pamphlets, views, maps, and transactions of Societies relating to Africa and African Islands. Offered at the prices affixed by Francis Edwards, Bookseller, 83, High Street, Marylebone, London, W. October, 1902. Size 8¾ × 5½, pp. 224 and 40. *Presented by Mr. Francis Edwards.*

Africa—Zoology. *P. Zoolog. S.* (1902, vol. ii.): 73–79. **Major.**
Dr. C. I. Forsyth Major. On the remains of the Okapi received by the Congo Museum in Brussels. *With Illustrations.*

Eritrea. **Melli.**
Manuali Hoepli. B. Melli. L'Eritrea dalle sue Origini a tutto l'anno 1901. Appunti Cronistorica. Milan: Ulrico Hoepli. 1902. Size 6 × 4, pp. xii. and 164. *Maps. Price 2 lire. Presented by the Publisher.*

A summary of the history of Eritrea.

French Congo. *Rev. Colon.* (1902): 531–550. **Pauwel.**
De Bangui à Carnot et retour. Par R. de Pauwel.

German East Africa. *M. Deutsch. Schutzgeb.* **15** (1902): 133–138. **Adams.**
Das mittlere Flussgebeit des Lukuledi. Von P. Alf. Adams. *With Map.*

The Lukuledi is the river debouching into Lindi bay.

German East Africa. **Stuhlmann.**
Berichte Land- u. Forstwirtschaft Deutsch.-Ostafrika 1 (1902): 1–23.
Uebersicht über Land- und Forstwirtschaft in Deutsch-Ostafrika im Berichtsjahre vom 1. Juli 1900 bis 30. Juni 1901. Zusammen-gestellt von Regierungsrat Dr. Franz Stuhlmann.

German East Africa—Tsetse Fly. **Stuhlmann.**
Berichte Land- u. Forstwirtschaft Deutsch-Ostafrika 1 (1902): 137 153.
Notizen über die Tsetsefliege (Glossina morsitans Westw.) und die durch sie übertragene Surrahkrankheit in Deutsch-Ostafrika. Von Regierungsrat Dr. Franz Stuhlmann. *With Map and Illustrations.*

Kamerun. *M. Deutsch. Schutzgeb.* 15 (1902): 123–130. **Foerster and Moisel.**
Bericht über eine Erkundung des mittleren Kampoflusses. Von Oberleutnant Foerster. *With Map.*
Bemerkungen zu der Karte des Gebietes am unteren Kampo. Von M. Moisel.

Lieut. Foerster was a member of the recent boundary survey along the southern frontier of the Kamerun.

Madagascar. **Gautier.**
Madagascar. Essai de Géographie Physique. Par E. F. Gautier. Paris: A. Challamel, 1902. Size 11 × 7½, pp. 428. *Maps, Illustrations, and Diagrams. Price* 25*s.*

This important work will be reviewed elsewhere.

Madagascar. *La G., B.S.G. Paris* 6 (1902): 1–16. **Grandidier.**
Une mission dans la région australe de Madagascar en 1901. Par G. Grandidier. *With Map and Illustrations. Also separate copy, presented by the Author.*

Morocco. *Mém. S.G. Genève* 41 (1902): 41–61. **Montet.**
Le grand Atlas et le Sud-Marocain. Par E. Montet.

The writer made the journey from Marakesh to the coast through a portion of the Atlas range.

Morocco—People. **Meakin.**
The Moors, a comprehensive description. By Budgett Meakin. London: Sonnenschein & Co., 1902. Size 9 × 6, pp. xxii. and 504 *Illustrations. Price* 15*s. Presented by the Author.*

Niger. *Rev. Française* 27 (1902): 589–600. **Lenfant.**
La navigabilité du Niger. Par Capitaine E. Lenfant.

Nigeria. **Mockler-Ferryman.**
British Nigeria. A Geographical and Historical description of the British Possessions adjacent to the Niger River, West Africa. By Lieut.-Col. A. F. Mockler-Ferryman. London, &c.: Cassell & Co., 1902. Size 9½ × 6, pp. viii. and 352. *Map and Illustrations. Price* 12*s.* 6*d. net. Presented by the Publishers.*

North and East Africa. **Pease.**
Travel and Sport in Africa. By A. E. Pease. 3 vols. London: A. L. Humphreys, 1902. Size 13 × 10½, pp. (vol. i.) xviii. and 360; (vol. ii.) xii. and 314; (vol. iii.) x. and 232. *Maps and Illustrations. Price* £10 10*s. net. Presented by the Publisher.*

This will be specially noticed.

Rhodesia. **Peters.**
The Eldorado of the Ancients By Dr. Carl Peters. London: C. Arthur Pearson, 1902. Size 9 × 5½, pp. x. and 448. *Maps and Illustrations. Price* 21*s. net. Presented by the Publishers.*

See review in the *Journal* for November, 1902.

Sahara. *Rev. Française* 27 (1902): 544–550. **Huguenot.**
Les puits au Sahara. Par Père Huguenot. *Map.*

South Africa—Meteorology. *T. S. African Philosoph. S.* 11 (1902): 243–318. **Sutton.**
Some Pressure and Temperature Results for the Great Plateau of South Africa. By J. R. Sutton. *With Diagrams.*

Togo. *M. Deutsch. Schutzgeb.* 15 (1902): 120–122. **Messerschmitt and Ambronn.**
Breitenbestimmungen in Togo, angestellt vom Hauptmann v. Doering. Berechnet

von Dr. J. B. Messerschmitt. Astronomische Beobachtungen von Dr. Gruner, 1897. Berechnet von Prof. Dr. Ambronn.

Resultate der astronomischen Beobachtungen des Herrn H. Klose, 1897.

Tripoli. **Ricchieri.**

G. Ricchieri. La Tripolitània e l'Italia. Milano: Albright, Segati, e C., 1902. Size 9 × 6, pp. 62. *Presented by the Publishers.*

The author considers that the future relations of Italy with Tripoli should be concerned rather with an extension of commercial intercourse than with direct political control.

Tripoli and Tunis. **Schoenfield.**

Aus den Staaten der Barbaresken. Von Dr. E. Dagobert Schoenfield. Berlin: Dietrich Reimer, 1902. Size 10½ × 7, pp. 268. *Plates. Price 6m. Presented by the Publisher.*

West Africa. *Rev. Colon.* (1902): 607–624. ——

Rapport de délimitation Franco-Portugaise de la Commission entre le Congo et le Cabinda

NORTH AMERICA.

Canada—Historical. *P. and T.R.S. Canada* 7 (1901): (Sec. I.) 97 116. **Sulte.**

La Rivière des Trois-Rivières. Par M. B. Sulte. *With Map.*

Canada—Historical. *P. and T.R.S. Canada* 7 (1901): (Sec. I.) 47 96. **Sulte.**

Le Fort de Frontenac, 1668-1678. Par M. Benjamin Sulte.

Canada—New Brunswick. *P. and T.R.S. Canada* 7 (1901) (Sec. IV.): 45–56. **Ells.**

The Carboniferous Basin in New Brunswick. By R. W. Ells, LL.D.

United States—Arkansas. **Branner.**

Annual Report of the Geological Survey of Arkansas for 1892. Volume V. The Zinc and Lead Region of North Arkansas. By John C. Branner. With Atlas. Little Rock, 1900. Size 9 × 6, pp. xiv. and 396 *Maps and Illustrations. Presented by Dr. J. C. Branner.*

United States—Census. **Hunt.**

Census Reports Vol ii. Twelfth Census of the United States, taken in the year 1900. William R. Merriam, Director. Population. Part ii. Prepared under the supervision of William C. Hunt, Chief Statistician for Population (pp. ccxxiv. and 754). Ditto, Vols. v. and vi. Agriculture, Parts i. and ii. Farms, Live Stock and Animal Products (pp. cexxxvi and 768). Crops and Irrigation (pp. 880). Ditto, vols. vii.–ix. Manufactures, Parts i.–iii. United States by Industries (pp cccxlii. and 698). States and Territories (pp. x. and 1102). Special Reports on Selected Industries (pp. xxiv. and 1120). Washington: U.S. Census Office, 1902. Size 12 × 9½. *Maps and Diagrams. Presented by the Director of the Census.*

United States—Education. ——

Board of Education Special Reports on Educational Subjects. Vols. 10 and 11. Education in the United States of America. London: Eyre & Spottiswoode, 1902. Size 9½ × 6, pp. (vol. 10) vi. and 526; (vol. 11) vi. and 612. *Price (vol. 10) 2s. 3d.; (vol. 11.) 2s. 6d.*

United States—Geodesy. **Schott.**

Treasury Department. U.S. Coast and Geodetic Survey. Special Publication, No. 7. Geodesy. The Eastern Oblique Arc of the United States and Osculating Spheroid. By Chas. A. Schott. Washington, 1902. Size 11½ × 9, pp. 394. *Maps, Diagrams, and Illustrations. Presented by the U.S. Treasury Department.*

United States—Geodesy. ——

Report of the Superintendent of the Coast and Geodetic Survey, showing the progress of the work from July 1, 1899, to June 30, 1900. Washington, 1901. Size 12 × 9½, pp. 724. *Maps and Illustrations. Presented by the U.S. Coast and Geodetic Survey.*

Ditto, July 1, 1900, to June 30, 1901, pp. 440.

United States—Geological Survey. **Warman.**

B.U.S. Geolog. Surv. No. 177, *Washington*, 1901, *pp.* 858.

Catalogue and Index of the Publications of the United States Survey, 1880–1901. By Philip Creveling Warman

United States—Massachusetts. ——

Essex Institute Historical Collections **38** (1902): 225–256.

The Misery Islands, and what has happened there. *Map, Illustrations, and facsimiles.*

The Misery islands were much concerned in the history of early settlement.

United States—Minerals. **Hay.**

Department of the Interior. United States Geological Survey. Mineral Resources of the United States. Calendar Year 1900, David T. Hay, Chief of Division of Mining and Mineral Resources. Washington, 1901. Size 9 × 6, pp. 928. *Diagram. Presented by U.S. Department of Interior.*

United States New York. ——

Report of the Board of Rapid Transit Railroad Commissioners for and in the City of New York up to December 31, 1901. Accompanied by Reports of the Chief Engineer, and of the Auditor. New York, 1902. Size 10½ × 7, pp. 300. *Plans. Presented by the Board of Rapid Transit Railroad Commissioners, New York.*

United States—Oilfields. **Adams.**

B.U.S. Geolog. Surv. No. 184, *Washington*, 1901, *pp.* 64.

Oil and Gas Fields of the Western Interior and Northern Texas Coal Measures, and of the Upper Cretaceous and Tertiary of the Western Gulf Coast. By George J. Adams. *Maps, Plates, and Diagrams.*

United States—Rocky Mountains. *National G. Mag.* 13 (1902): 361–372. **Chapman.**

Our Northern Rockies. By R. H. Chapman. *Illustrations.*

Deals chiefly with the Lewis and Clarke Timber Reserve in Montana, recently surveyed by the U.S. Geological Survey.

United States—Rocky Mountains. **Glass.**

Chinook Winds. By E. J. Glass. (Proceedings of the Second Convention of Weather Bureau Officials held at Milwaukee, Wis., August 27, 28, 29, 1901, pp. 41–43.) Washington, 1902. *Plate.*

United States—Sailing Directions ——

Supplement, 1902, relating to Sailing Directions for the East Coast of the United States, 1899. (Corrected to August, 1902.) London, 1902. Size 9½ × 6, pp. 56. *Price* 8*d. Presented by the Hydrographer, Admiralty.*

United States Surveys. **Wilson and Others.**

B.U.S. Geolog. Surv. No. 185, *Washington*, 1901, *pp.* 220.

Results of Spirit Levelling, fiscal year 1900–01. By H. M. Wilson, J. H. Renshawe, E. M. Douglas, and R. M. Goode.

United States—Texas. *B.U.S. Geol. Surv. No.* 194, *Washington*, 1902, *pp.* 52. **Baker.**

The North-West Boundary of Texas. By Marcus Baker. *Maps and Diagrams.*

This will be noticed in the Monthly Record.

United States—Texas. *B.U.S. Geol. Surv. No.* 190, *Washington*, 1902, *pp.* 162. **Gannett.**

A Gazetteer of Texas. By Henry Gannett. *Maps.*

Opens with a valuable monograph on the State, the various distributions in which are illustrated by maps.

United States—Texas. *B.U.S. Geol. Surv. No.* 178, *Washington*, 1901, *pp.* 16. **Weed.**

The El Paso tin deposits. By Walter Harvey Weed. *Maps and Diagrams.*

These deposits occur on the east flank of the Franklin mountains, in the extreme western corner of Texas.

CENTRAL AND SOUTH AMERICA.

Argentine Republic. *Rev. Museo La Plata* **10** (1902): 257–264. **Quevedo.**

Las ruinas de Pajanco y Tuscamayo entre Siján y Pomán. Por Samuel A. Lafone Quevedo. *With Plate.*

Argentine Republic. ——

Ministerio de Obras Publicas de la República Argentina. Memoria al Honorable Congress. 1° Enero 1898–31 Julio 1899. Segunda Edicion. Buenos Aires, 1899. Size 10½ × 7, pp. 208. *Map and Diagrams.*

Ditto. (Segunda Memoria.) Buenos Aires, 1901. Size 10½ × 7, pp. 396. *Maps, Plans, and Diagrams. Presented by Dr. F. P. Moreno.*

Argentine Republic. —

República Argentina. Ministerio de Obras Publicas. Inspección General de Navegación y Puertos. Concurso para la Construcción y Explotación de un Puerto Comercial en la cuidad del Rosario. Documentos Preliminares. Anexos A, B–H X, O, & Indices y Tabla Analítica. 12 vols. Buenos Aires. G. Kraft, 1900. Size 10½ × 7. *Maps, Plans, etc.* ***Presented by Dr. F. P. Moreno.***

Barbados. *Geolog. Mag.* **9** (1902): 550–554. **Harrison and Jukes-Browne.**

The Geology of Barbados. By Prof. J. B. Harrison, C.M.G., and A. J. Jukes-Browne.

Brazil. **Funke.**

Aus Deutsch-Brasilien. Bilder aus dem Leben der Deutschen im Staate Rio Grande do Sul von Alfred Funke. Leipzig: B. G. Teubner, 1902. Size 10 × 7, pp. viii. and 288. *Map and Illustrations.* *Price 8s.*

Dominica. **Bell**

Dominica. Report on the Caribs of Dominica. Colonial Reports, Miscellaneous, No. 21, 1902. Size 10 × 6, pp. 16. *Map.* *Price 2d.*

Dutch Guiana. *Tijds. K. Ned. Aard. Genoots. Amsterdam* **19** (1902): 695–852. **Bakhuis.**

Verslag der Coppename-expeditie. Door L. A. Bakhuis. ***With Map and Illustrations.***

This was noticed in the December number (vol. xx. p. 656). The map is on the scale of 1 : 200,000.

Ecuador. *Rev. G.* **26** (1902): 220–228. **Bourgeois.**

La Republique de l'Équateur. Ses conditions économiques, ses ressources et son avenir. Par Commandant R. Bourgeois.

Patagonia. **Prichard.**

Through the Heart of Patagonia. By H. Hesketh Prichard. London: W. Heinemann, 1902. Size 11 × 7½, pp. xvi and 346. *Maps, Plates (Coloured and Photogravure), and Illustrations.* *Price 21s. net.* ***Presented by the Publisher.***

This has been noticed elsewhere (vol. xx. p. 644).

Peru. —

Guide du Perou pour Capitalistes et Emigrants. Lima, 1902. Size 7½ × 5½, pp. xiii. and (48). *Maps and Illustrations.*

Peru. *B.S.G. Lima* **10** (1900): 197–207. —

De Quilca á Puno. Por Pentland. ***With Map and Diagram.***

Peru. —

El Perú para la Immigración. Región del Ucayali. Size 8 × 5½, pp. 20. *Map and Illustrations.* ***Presented by the Peruvian Chargé d'Affaires.***

Peru. **Vanderghem and Others.**

Rapports présentés au Ministre de l'Agriculture et des Travaux publics du Pérou sur divers voyages entrepris dans quelques régions de la République par MM. les ingenieurs agronomes G. Vanderghem. H. van Hoorde, J. Michel, V. Marie et le Médecin-Vétérinaire A. Declerq. 1902. Size 7½ × 5½, pp. iv. and 214. *Maps and Illustrations.* ***Presented by the Peruvian Chargé d'Affaires.***

Deals chiefly with the economic resources of various parts of Peru.

South America. **Fountain.**

The Great Mountains and Forests of South America. By Paul Fountain. London, etc.: Longmans, Green & Co., 1902. Size 9 × 5½, pp. 306. *Portrait and Illustrations.* ***Presented by the Publishers.***

South America—Andes. **Burckhardt**

Anales del Museo de La Plata. Materiales para la Historia del Continente Sud-Americano. Sección Geológica y Mineralógica. III. Coupe Géologique de la Cordillère entre Las Lajas et Curacautin par le Dr. Carl Burckhardt. La Plata, 1900. Size 14½ × 11, pp. 102. *Maps, Diagrams, and Illustrations.* ***Presented by Dr. Moreno.***

West Indies. *Ann. Hydrographie* **30** (1902): 429–436. **Schott**

Ozeanographische Beobachtungen während einer Reise nach den westindischen Gewässern. Von Dr. G. Schott.

West Indies—Cuba. *B.U.S. Geol. Surv. No.* 192, *Washington*, 1902, *pp.* 114. **Gannett.**

A Gazetteer of Cuba. By Henry Gannett. *Maps.*

The gazetteer proper is preceded by a useful sketch of the geography, resources, climate, population, etc., of Cuba.

West Indies—Martinique. *Tour du Monde* **8** (1902): 397–408. ———

La Catastrophe de la Martinique. *Map and Illustrations.*

West Indies—Martinique. *Fortnightly Rev.* **72** (1902): 469–479. **Heilprin.**

Mont Pelée in its Might. By Prof. Angelo Heilprin.

Prof. Heilprin ascended to the crater of Mont Pelée in May last, while the volcanic forces were still in a state of disturbance.

West Indies—Martinique. **Lacroix, Rollet de l'Isle and Giraud.**

C. Rd. **135** (1902): 377–391, 419–431.

Sur l'éruption de la Martinique. Note de MM. A. Lacroix, Rollet de l'Isle et Giraud.

West Indies—Martinique. **Lacroix, Rollet de l'Isle and Giraud.**

Rev. Scientifique **18** (1902): 327-333, 390-396.

L'éruption de la Martinique. Rapport de MM. A. Lacroix, Rollet de l'Isle et Giraud. Ditto, Deuxième Rapport.

West Indies—Martinique and St. Vincent. **Hovey.**

Martinique and St. Vincent: a Preliminary Report upon the Eruptions of 1902. By Edmund Otis Hovey. (Author's Edition, extracted from Bulletin of the American Museum of Natural History, vol. xvi., article xxvi., pp. 333-372.) New York, 1902. Size 10 × 6½. *Maps and Plates.*

This was noticed in the December number (p. 638).

West Indies—St. Vincent. **Huggins.**

An Account of the Eruptions of the Saint Vincent Soufrière, with Woodcuts. By P. Foster Huggins. Printed at the *Times* Printing Office, Saint Vincent. [1902.] Size 7 × 5, pp. 32.

West Indies—St. Vincent and Martinique. ———

West Indies. Correspondence relating to the Volcanic Eruptions in St. Vincent and Martinique in May, 1902. *With Map and Appendix.* London: Eyre & Spottiswoode, 1902. Size 13½ × 8½, pp. xvi. and 100. *Price* 1*s*. 3*d*.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Climate. *Queensland G.J.* 17 (1901–1902): 144–158. **Nelson.**

Anniversary Address to the Royal Geographical Society of Australasia, Queensland. By the Right Hon. Sir Hugh M. Nelson, K.C.M.G.

On the Climate of Australia.

Australia—Gums and Resins. **Maiden.**

J. and P.R.S. New South Wales **35** (1901): 161–212.

The Gums, Resins, and other Vegetable Exudations of Australia. By J. H. Maiden.

British New Guinea. *Queensland G.J.* 17 (1901–1902): 117–143. **Maguire.**

Impressions of a Year's Sojourn in British New Guinea. By H. R. Maguire.

Chatham Island. *T. and P. New Zealand I.* **34** (1901): 243–325. **Cockayne.**

A Short Account of the Plant-covering of Chatham Island. By L. Cockayne. *With Map and Plates.*

Santa Cruz Islands. *Records Australian Museum* **4** (1902): 289-291. **Etheridge.**

The Tavau, or Coil Feather currency of Santa Cruz Island, Santa Cruz Group. By R. Etheridge, jun.

Society Islands—Tahiti. *Tour du Monde* **8** (1902): 481-492. **Myrica.**

Tahiti—Notes et Impressions. Par M. Pierre de Myrica. *Map and Illustrations.*

South Australia—Discovery. ———

The Flinders Centenary. Incidents of an Historic Voyage. Reprinted from the *Register*, 1902. Adelaide, 1902. Size 8½ × 5½, pp. 18. *Illustrations.*

Tasmania. *P.R.S. Victoria* **15** (1902): 28-35. **Kitson.**

On the Occurrence of Glacial Beds at Wynyard, near Table Cape, Tasmania. By A. E. Kitson. *With Map.*

Victoria. ——

Statistical Register of the Colony of Victoria, etc. 1900. Compiled from Official Records in the Office of the Government Statist. Melbourne, [not dated]. Size $12\frac{1}{2} \times 8$, pp. [698] and 66.

Western Australia—Calvert Expedition. ——

Western Australia. Journal of the Calvert Scientific Exploring Expedition, 1896–1897. Perth, 1902. Size $13\frac{1}{2} \times 8\frac{1}{2}$, pp. 62. *Map and Illustrations. Presented by the Surveyor-General.*

A reprint of the journal kept from day to day, apparently by the leader, Mr. L. A Wells. No explanation is given of the delay which has occurred in its publication. The map shows the route on the scale of 24 miles to the inch.

POLAR REGIONS.

Antarctic. **Bellingshausen.**

F. von Bellingshausens Forschungsfahrten im Südlichen Eismeer. 1819–1821. Auf Grund des russischen Originalwerks, herausgegeben vom Verein für Erdkunde zu Dresden. Leipzig: S. Hirzel, 1902. Size 9×6, pp. v. and 204. *Price 5s.*

Arctic. **Abruzzi, Cagni, and Molinelli.**

S. A. R. Luigi Amedeo di Savoia, Duca degli Abruzzi, U. Cagni, A. Cavalli Molinelli. La "Stella Polare" nel Mare Artico. 1899–1900. Milan: U. Hoepli, 1903 (1902). Size 10×7, pp. xii. and 592. *Maps, Plates, and Illustrations. Presented by the Duke of the Abruzzi.*

Arctic—Novaya Zemlya. **Moriak.**

A travers le Monde, Tour du Monde **8** (1902): 365–366.

L'Expédition du Capitaine russe Varnek à la Nouvelle-Zemble et à la Mer de Kara. Par M. Moriak. *With Map.*

Arctic Ocean. *P. American Philosoph. S.* **41** (1902): 154–161. **Bryant.**

Drift Casks in the Arctic Ocean. By Henry G. Bryant.

Arctic—Smith Sound. *Petermanns M.* **48** (1902): 195–201. **Stein.**

Geographische Nomenklatur bei den Eskimos des Smith-Sundes. Von Dr. Robert Stein. *With Map.*

Arctic—Russian Expedition. *Z. Ges. Erdk. Berlin* (1902): 630–634. **Toll.**

Von der Russischen Polar-Expedition, Berichte des Leiters der Expedition Baron Eduard Toll. 2. Kurzer Bericht für das Jahr 1901.

Arctic—Russian Expedition. *Petermanns M.* **48** (1902): 179–184. **Toll.**

Russische Polar-Expedition unter Leitung von Baron Ed. Toll. Bericht über die Tätigkeit und Verlauf der Expedition im Jahre 1901. Von Eduard von Toll.

Cf. article in *Journal* for August, 1902 (p. 216).

Spitsbergen. *B.G. Hist. et Descriptive* (1901): 32–62. **Hamy.**

Une Croisière française à la Côte Nord du Spitzberg en 1693. Par E. T. Hamy. *With Map.* [See note at p 85, *ante.*]

MATHEMATICAL GEOGRAPHY.

Astronomy.

Connaissance des Temps ou des Mouvements Célestes, pour le Méridien de Paris, à l'usage des Astronomes et des Navigateurs, pour l'an 1905, publiée par le Bureau des Longitudes. Paris: Gauthier Villars, 1902. Size $9\frac{1}{2} \times 6\frac{1}{2}$, pp. viii., 814, and 110. *Diagrams.*

Cartography. **Brunker.**

Notes on Maps and Map-reading for the guidance of Majors preparing for the "Tactical Fitness" Examination; and for Officers in instructing their N.C. Officers and men. By Lieut.-Colonel H. M. E. Brunker. London: W. Clowes & Sons, Ltd, 1902. Size 7×4, pp. vi. and 52. *Illustrations. Presented by the Publishers.*

Cartography. **Morrison.**

Maps: their Uses and Construction. A short popular treatise on the advantages and defects of Maps on various projections, followed by an outline of the principles involved in their construction. By G. James Morrison. Second Edition. Revised

and Enlarged London: Edward Stanford, 1902. Size 8 × 5, pp. xii and 152. *Diagrams. Price 5s. net. Presented by the Author.*

Most of the suggestions made in the review of the first edition (*Journal*, vol. xviii. p. 528) have been adopted in this edition.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Earthquakes.

Kaiserl. Akademie der Wissenschaften in Wien. Mittheilungen der Erdbeben-Commission der Kaiserlichen Akademie der Wissenschaften in Wien. Neue Folge Nos. 1–8. Wien, 1901–1902. Size 9½ × 6½, pp. 64, 114, 56, 24, 52, 56, 116, and 36. *Maps, Plate, and Diagram.*

Geological History. **Ackroyd.**

P. Yorkshire Geolog. and Polytechnic S. **14** (1902)· 401–421.

On the Circulation of Salt and its Bearing on Geological Problems, more particularly that of the Geological Age of the Earth. By William Ackroyd. *With Diagrams*

Geomorphology. **Neuber.**

Wissenschaftliche Charakteristik und Terminologie der Bodengestalten der Erdoberfläche. Von August Neuber. Wien und Leipzig: W. Braumüller, 1901. Size 10 × 6½, pp. xii. and 648. *Presented by the Publisher.*

Oceanography—Red Sea. *Sitzb. K.A.W. Wien* **110** (1901) (*Abth. I.*): 249–258. **Fuchs.**

Ueber den Charakter der Tiefseefauna des Rothen Meeres auf Grund der von den österreichischen Tiefsee-Expedition gewonnenen Ausbeute. Von Theodor. Fuchs.

Physical Geography. **Gilbert and Brigham.**

Twentieth Century Text-books. An Introduction to Physical Geography. By Grove Karl Gilbert and Albert Perry Brigham. London: Hirschfeld Brothers, 1902. Size 8 × 5, pp. xvi. and 380. *Maps and Illustrations. Price 5s. net. Presented by the Publishers.*

Physical Geography. **Suess.**

La Face de la Terre. (Das Antlitz der Erde.) Par Ed. Suess. Traduit avec l'Autorisation de l'Auteur par Emmanuel de Margerie. Tome iii. (1[re] Partie). Paris: Armand Colin, 1902. Size 10 × 6½, pp. xii. and 530. *Maps and Illustrations. Price 15 fr. Presented by the Publishers.*

This will be specially noticed.

Rivers. **Herrmann.**

Forecasting for Rivers of Small Drainage Area, especially those of North Carolina. By C. F. von Herrmann. (Proceedings of the Second Convention of Weather Bureau Officials held at Milwaukee, Wis., August 27, 28, 29, 1901, pp 158–167.) Washington, 1902.

Discusses the influence on the flow of rivers of geological, topographical, and meteorological conditions.

Rivers. *National G. Mag.* **13** (1902): 373–384. **Jefferson.**

Limiting Width of Meander Belts. By Prof. Mark S. W. Jefferson. *Diagrams.*

Discussed chiefly from a mathematical point of view.

River Basins. *B. Union G. Nord de la France* **23** (1901): 195–208. **Conrad.**

Essai d'une théorie des bassins fluviaux et de l'érosion des masses continentales. Par H. Conrad.

The author attempts a more precise definition of river-basins than is generally given, paying attention to the flow of underground as well as sub-aërial waters.

River Curves. *Geolog. Mag.* **9** (1902): 450–455. **Callaway.**

On a Cause of River Curves. By C. Callaway, D.SC. *With Diagrams.*

The influence of the junction of tributaries is considered of importance in the development of curves.

Volcanoes. *Rev. Scientifique* **18** (1902): 296–304. **Taquin.**

A propos de la théorie des volcans. Par A. Taquin.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Historical—Toscanelli. . **Gravier.**

La Lettre et la Carte de Toscanelli à Fernam Martins et à Christophe Colomb d'après Henry Vignaud Par M. Gabriel Gravier. (From the *B.S. Normande G.* 1902. Rouen: E. Cagniard, 1902. Size 9 × 7, pp. 24. *Price* 4*s.*

History. **Brandt, Schurtz, etc.**

Weltgeschichte. Zweiter Band. Ostasien und Ozeanien. Der Indische Ozean Von Max von Brandt, Dr. Heinrich Schurtz, Prof. Dr. Karl Weule, and Prof. Dr Emil Schmidt Leipzig and Wein: Bibliographisches. Institut., 1902. Size 10½ × 7, pp. xvi and 638 *Maps and Plates.*

BIOGRAPHY.

Chalmers **Lovett.**

James Chalmers His Autobiography and Letters. By Richard Lovett, M.A. Third Impression. London: The Religious Tract Society, 1902. Size 9 × 5½, pp 512. *Maps and Portraits. Price 7s. 6d. net. Presented by the Religious Tract Society* [To be reviewed]

Frobisher. *Hull Lit. Club Mag* **2** (1901-1902): 217-219. **Blyth.**

Sir Martin Frobisher: a Yorkshire Elizabethan Seaman. By Robert Blyth, jun.

Hall and Foxe *Hull Lit. Club Mag.* **2** (1901-1902): 239 241. **Dixon.**

The Records relating to Masters James Hall and Luke Foxe, Hull Seamen. By Ronald Dixon.

Parmentier. **Gravier.**

Notice sur Jean Parmentier; Navigateur Dieppois (1494 1530). Par M Gabriel Gravier. Rouen: E. Cagniard, 1902. Size 9 × 7, pp. 14. *Price* 4*s.*

Sabine. *Terrestrial Magnetism* 7 (1902): 131-140. ——

Biographical Sketch of General Sir Edward Sabine, F.R.S., K.C.B. *With Portrait.*

Scheuchzer. **Hoeherl.**

Johann Jacob Scheuchzer, der Begründer der physischen Geographie des Hochgebirges. Von Dr. Franz Xaver Hoeherl. (Munchener geographische Studien, herausgegeben von Siegmund Günther. Zehntes Stück.) München: T. Ackermann, 1901. Size 9 × 6, pp. viii. and 108.

Scheuchzer (born at Zürich, August 2, 1672) was the first to study scientifically, not only the outer form. but the structure, meteorology, glaciers, etc., of the Alps.

GENERAL.

Almanac. **Olsen.**

The Fisherman's Nautical Almanack and Tide Tables. A Directory of British and Foreign Fishing Vessels, Steamers, etc. By O. T. Olsen. 27th Year, 1903. Size 7 × 5, pp. xxxviii and 514. *Price* 1*s. Presented by the Author.*

Antwerp Exhibition. ——

Anvers—Mai-Juillet 1902. Catalogue de l'Exposition Cartographique, Ethnographique et Maritime . . . organisée, par la Société Royale de Géographie d'Anvers. Anvers, 1902. Size 8½ × 6, pp. xxxii. and 368. *Plates.*

Atlantis. *Geolog. Mag.* **9** (1902): 455-456. **Scharff.**

Some Remarks on the Atlantis Problem. By R. F. Scharff, PH.D.

Bibliography—Geology. ——

Geological Literature added to the Geological Society's Library during the Year ended December 31, 1901. Compiled by the Assistant-Librarian and edited by the Assistant-Secretary. London: Geological Society, 1902. Size 9 × 5½, pp. 196. *Price* 2*s. Presented by the Geological Society.*

British Association. ——

The British Association at Belfast. Special Report. (The *Irish Naturalist*, November, 1902, pp 253-310) Dublin: Eason & Son. Size 8½ × 5½. *Presented by the Editors.*

Catalogue. —

Catalogue of the Library of the Zoological Society of London. Fifth Edition. London: Taylor and Francis, 1902. Size 9 × 5½, pp. 856. *Presented by the Zoological Society.*

The Library now contains about 25,500 volumes, including many of geographical interest.

Colonisation. **Chailley-Bert.**

Les Compagnies de Colonisation sous l'ancien régime. Par Joseph Chailley-Bert. Paris: Armand Colin et Cie., 1898. Size 7½ × 4½, pp. 192. *Price 2s. 3d.*

On the system of "chartered companies" in former days in the principal European countries.

Eastern Asia and Africa. **Madrolle.**

De Marseille à Canton. Guide du Voyageur. Par Cl. Madrolle. Publié par le Comité de l'Asie Française. Indo-Chine, Canal de Suez, Djibouti et Harar, Indes, Ceylan, Siam, Chine Méridionale. Paris: Comité Asie Française, 1902. Size 7 × 4½, pp. viii., vi., 183, xiii.. and 186. *Maps and Plans. Price* 18 *fr. Presented by the Publishers.*

This is useful as the first attempt to provide the general traveller with a handy guide-book to the French possessions in the Far East. The bulk of the volume is devoted to Indo-China, but other countries of Eastern Asia are briefly touched upon.

Education—Map-drawing. **Scanlan.**

Memory Map-drawing. By a Professional Teacher. (R. G. Scanlan, Pialba State School, Queensland.) Halifax: Blatchford Brothers, 1902. Size 9½ × 7½, pp. 28. *Diagram and Maps. Presented by the Publishers.*

Exploration. **Hugues.**

Manuali Hoepli. L. Hugues. Cronologia delle Scoperte e delle Esplorazioni Geografiche, dall' anno 1492 a tutto il secòlo xix. Milan: Ulrico Hoepli, 1903. Size 6 × 4, pp. viii. and 488. *Price* 4.50 *lire. Presented by the Publishers.*

Geography. **Bosworth.**

Macmillan's Short Geography of the World. A New Handbook for Teachers and Students. By George F. Bosworth. London: Macmillan & Co., 1902. Size 7 × 4½, pp. vi. and 198. *Price* 1*s.* 6*d. Maps and Illustrations. Presented by the Publishers.*

This is little more than a summary of geographical facts, slight regard being paid to the relations of cause and effect, and it therefore possesses little educational value.

Malaria. **Stephens and Christophers.**

Royal Society. Reports to the Malaria Committee. Seventh Series. Reports from Messrs. Stephens and Christophers, India. London: Harrison & Sons, 1902. Size 8½ × 5½, pp. 52. *Illustrations. Price* 3*s. Presented by the Royal Society.*

Medical Geography. **Sedgwick and Winslow.**

Mem. American A. Arts. and Sci. **12** (1902): 521–577.

Statistical Studies on the Seasonal Prevalence of Typhoid Fever in Various Countries and its Relation to Seasonal Temperature. By William T. Sedgwick, PH.D., and Charles-Edward A. Winslow, S.M. *With Diagrams.*

Mountaineering. **Collie.**

Climbing on the Himalaya and other Mountain Ranges. By J. Norman Collie. Edinburgh: David Douglas, 1902. Size 9 × 5½, pp. xii. and 316. *Maps and Illustrations. Presented by the Publishers.*

This will be specially noticed.

Mountain-sickness. *Alpine J.* **21** (1902): 161–179. **Hepburn.**

Some Reasons why the Science of Altitude-illness is still in its Infancy. By Dr. M. L. Hepburn.

Nature Study. *Scottish G. Mag.* **18** (1902): 525–536. **Geddes.**

Nature Study and Geographical Education. By Prof. Patrick Geddes.

Place-names. *B.S.G. Genève* **41** (1902): 97–108. **Ottramare.**

Noms de lieux et de peuples. Par M. le Prof. Paul Ottramare.

Sailing Directions. **Maclear.**

Eastern Archipelago. Part i. (Eastern Part) comprising the Philippines, Sulu Sea, Sulu Archipelago, N.E. Coast of Borneo, Celebes Sea, N.E. Coast of Celebes,

Molucca and Gillolo Passages, Banda and Arafura Seas, N.W. and West Coasts of New Guinea, and North Coast of Australia. Compiled from various sources by Captain J. P. Maclear. London: Eyre & Spottiswoode, 1902. Size 9½ × 6, pp. xxxii. and 632. *Map. Price 4s. Presented by the Hydrographer, Admiralty.*

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Albania. **Institut Géographique de Bruxelles.**

Albania. Scale 1 : 500,000 or 7·8 stat. miles to an inch. Université Nouvelle. Institut Géographique de Bruxelles, 1902.

An orographical map of Albania, showing height of land by means of five different tints of brown, ranging from 100 to over 2000 metres. It is somewhat diagramatic in style, and few names are given. Two insets appear in the left-hand corner of the map, illustrating the geology and climatic conditions of the country.

England and Wales. **Ordnance Survey.**

ORDNANCE SURVEY OF ENGLAND AND WALES:—Revised sheets published by the Director-General of the Ordnance Survey, Southampton, from November 1 to 29, 1902.

1 inch:—

With hills in brown or black, 75, 114 (engraved). 1*s. each.*

Printed in colours: 96 and part of 83 (combined). 1*s.* 6*d.* 116 and part of 129 (combined), 121, 151, 152, 161. 1*s. each.*

6-inch—County Maps:—

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England and Wales. **Geological Survey.**

Maps (1-inch). New Series (colour-printed). Solid Edition, 232, 249. 1*s.* 6*d. each.*

(*E. Stanford, London Agent.*)

Rome. **Huelsen.**

Romæ veteris tabula in usum scholarum descripta. With inset plans, (1) Urbis Incrementa Regionatim descripta; (2) Urbis pars Media duplici Maioris Tabulæ Modulo descripta. Christian Huelsen. Scale 1 : 4,250 or 0·06 stat. mile to an inch. Four sheets. Berlin: Dietrich Reimer (Ernst Vohsen), 1901. *Price, unmounted in paper cover, 9 marks.*

This is a large wall-plan of ancient Rome, prepared specially for the use of schools. It is clearly executed in a bold style, and printed in colours.

ASIA.

Asia. **Service Géographique de l'Armée. Paris.**

Asie. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheets: 20 N., 108 E., Hué; 24 N., 114 E., Canton. Service Géographique de l'Armée. Paris, 1900–1901.

These two sheets form part of the large map of Asia, on the scale of 1 : 1,000,000, which has been commenced by the Service Géographique de l'Armée, Paris. They are printed in colours, and contain the results of survey work up to 1900.

Asiatic Russia. **Toll.**

Die Aufnahme der Taimyr-Bai 1900-01 durch Baron E. Toll. Scale 1 : 3,500,000 or 55 2 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1902. Gotha: Justus Perthes. *Presented by the Publisher.*

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, 4 miles to an inch. Sheets: 20 N.E., parts of Jodhpur (Native State, Rajputana Agency), additions up to 1901, 1902. 40 S.W., parts of districts Belgaum, Ratnágiri, and Sátára, Native States of Kolhápur and Southern Maratha and Satára Agencies (Bombay Presidency), 1901. 51 S.W., parts of Native States of Gwalior (C.I. Agency), Bundi, Tonk, Jaipur, Kotah, and Jhalawar (Rajputana Agency), with additions to 1899, 1901. 60 N.W., parts of districts Mysore, Hassan, Kadur, and Túmkúr (Mysore State), additions to 1896, 1901. 64 S.W., parts of district Kángra (Punjab), of Rukshu (Kashmir), and Great Tibet, additions to 1899. 69 S.E., parts of districts Hamirpur, Fatehpur, and Bánda (United Provinces of Agra and Oudh), and Native State of Bundelkhand (C.I. Agency), additions to 1899. 78 N.E., Madras district and parts of North Arcot, Nellore, and Chingleput district (Madras Presidency), additions to railways up to 1899. 105 S.W., parts of districts Biláspur and Sambalpur (Central Provinces); of district Ránchi and Tributary States Sarguja, Udaipur, Gángpur, and Jashpur (Chota Nágpur), additions to 1899, 1901. 124 S.W., parts of districts Kámrúp, Darrang, Gáro hills, Goálpára, and Khási and Jaintia hills (Assam), additions to 1901, 1902. 125 S.W., parts of districts Mymensingh (Bengal) and Sylhet (Assam), additions to 1901, 1902. 54, parts of districts Hoshangabad, Nimár, Wardha and Betul (Central Provinces), Amraoti, Akola, Buldána, and Ellichpur (Berar), Khandesh (Bombay Presidency), and of Native State Indore (C.I. Agency), additions to 1899.—Burma and adjacent countries, scale 32 miles to an inch, 2 sheets, second edition, with additions to boundaries and railways up to December, 1901, 1902.—The Central India Agency, scale 16 miles to an inch, 2 sheets and index, additions and corrections to 1901.—The North-Western Provinces and Oudh, showing the districts and states under the jurisdiction of the Lieutenant-Governor and Chief Commissioner, scale 16 miles to an inch, 2 sheets and index, with additions and corrections to 1901.—Lower Provinces Revenue Survey, 1 mile to an inch, district Monghyr, Seasons 1836–38 and 1845–47. Sheet 15 (second edition), with additions to boundaries, 1897, 1901, district Purneah. Sheet 12, with additions to boundaries and railways, 1897, 1901.—District of Surat, 5 miles to an inch. 1902.—Assam Survey, 1 mile to an inch. Sheets (Preliminary Edition) 8 and 9. District Goálpára, Seasons 1895–98, 1901–1902; (Preliminary Edition) 18, district Kámrup, Season 1896–97, 1902; (Second Prelimary Edition) 38 and portion of 37, districts Kámrup and Darrang, Seasons 1885–86, 1890–91, and 1896–97, 1902; (Preliminary Edition) 49, district Darrang, Seasons 1886–87, and 1895–96, 1902; (Preliminary Edition) 52, districts Kámrup and Nowgong, Seasons 1887–88, 1890–91, and 1897–99, 1902; (Preliminary Edition) 62 and 63, district Nowgong, Seasons 1887–88, 1890–91, and 1897–98, 1902; (Preliminary Edition) 163, North Lushai hills, Seasons 1898–99, 1900, 1901.—Bengal Survey, 1 mile to an inch. Sheets: 111, districts Muzaffarpur and Champáran, Seasons 1893–96, 1902; (Preliminary Edition) 143, district Muzaffarpur, Seasons 1885–86 and 1893–95, 1901; 285 and portion of 308, district Hooghly, Seasons 1869–70,

1901.—Bombay Survey, 1 mile to an inch. Sheet 135, district Thána and Jawhár State, Seasons 1884–85, 1902.—Burma Survey, 1 mile to an inch. Sheets: 125 (142 Old Series), districts Bassein and Myaungmya, Seasons 1879–80, 1901; (Preliminary Edition) 190 (New Series), district Shwebo, Seasons 1892–96, 1901; 240 (New Series) districts Mandalay, Ruby Mines, Shwebo and Hsi Paw (North Shan States), Seasons 1890–91 and 1897–1900, 1901; (Preliminary Edition) 244 (262 Old Series), districts Sagaing, Kyaukse, Mandalay and Southern Shan States, Seasons 1889–90, 1891–92, and 1898–1900, 1902; 255 (273 Old Series), district Toungu, Seasons 1890–91–92, 1901; (Second Edition) 305 (324 Old Series), districts Pegu and Toungu, Seasons 1895–98, 1901; (Second Edition) 307 (326 Old Series), districts Pegu and Thâton, Seasons 1881–81 and 1894–97, 1901; (351 New Series), district Thâton, Season 1892–95, 1901; (Preliminary Edition) 435 (New Series), parts of South Hsenwi and Manglon States, Season 1899–1900, 1901; 436 (New Series), parts of Northern and Southern Shan States, Season 1899–1900, 1901.—Madras Survey, 1 mile to an inch. Sheet 74, part of district Túmkúr (Mysore). Season 1876–78, with additions to roads, canals, etc., up to 1896, 1901.—South-Eastern Frontier, 4 miles to an inch (Seventh Edition). Sheet: 1 s.w., Upper Burma, parts of districts Ruby mines, Schwebo, Sagaing, Mandalay, and of Northern Shan States, Seasons 1886–93, with additions and corrections up to December, 1900, 1902.—North-Western Province and Oudh Survey, 1 mile to an inch. Sheets: (Preliminary Edition) 70, district Shahjanpur, Seasons 1895–97, 1902; 85, district Budaun, Season 1877–78, corrections to boundary up to October, 1900, 1901; 168, districts Mirzapur and Jaunpur, Seasons 1877–81, and 1885–86, with additions and corrections to railways, etc., up to May, 1899, 1901; 195, districts Jaunpur, Ghazipur and Benares, Seasons 1879–81, with additions and corrections to railways and roads, etc., up to June, 1897, 1901; 211 and 52, parts of Gorakhpur (N.W. Provinces and Oudh) and Champáran (Bengal), Seasons 1885–87, 1892–93, and 1894–96, 1902.—Hyderabad Assigned districts, district of Ellichpur, 8 miles to an inch, 1901.—Assam, district Goálpára, 8 miles to an inch, 1901; district Sylhet, 8 miles to an inch, 1902.—Chart of Traverse, No 20, party (Burma forest), 24 miles to an inch. Sheet 213 (New Series). Season 1893–94, 1902; Chart of Triangulation, No 20 party (Burma), 2 miles to an inch. Sheets: 253 (New Series), Season 1891 93, 1902; 255 (New Series), Seasons 1885–92, 1902; 257 (New Series), Seasons 1894–96, 1902; 258 (New Series), Seasons, 1882–83–84, 1886–87, and 1895–96, 1902

Indo-China. **Service Géographique de l'Indo-Chine.**

Carte de l'Indo-Chine Scale 1 : 100,000 or 1·5 stat. miles to an inch. Sheets: Cap-Varella, Phan-Rang, Saigon, M'Sao, Da R'Lac, Dan-Kia, Dan-Kia (Ouest), Djirinh, Mi-Pou, Tam-Linh. Service Géographique de l'Indo-Chine, 1901–1902.

Indo-China **Service Géographique de l'Indo-Chine.**

Environs de Saigon. Scale 1 : 20,000 or 0·31 stat. mile to an inch 5 sheets. Service Géographique de l'Indo-Chine, 1900.

This forms one of a series of maps now being published of the environs of towns and important districts in French Indo-China, on comparatively large scales. It is based upon the surveys of French officers, and is clearly printed in colours.

AMERICA.

Canada. **Geological Survey.**

Geological Map of the Dominion of Canada (Western Sheet, No. 783). Scale 1 : 3,168,000 or 50 stat. miles to an inch. Geological Survey of Canada. Ottawa, 1901. *Presented by the Geological Survey of Canada.*

It is, of course, too early to expect anything like a complete geological map of the whole of the Dominion of Canada, as there are many areas concerning which very little is at present known Still, the members of the Geological Survey have been most energetic in their investigations, and Dr. Bell, under whose superintendence the work is now carried on, has been able to produce a geological map which is a great advance on anything of the kind hitherto published. There are, of necessity, many generalizations, especially in the complicated mountain systems of northern British Columbia, the upper Yukon, and other little-known districts of the far north, which regions will be dealt with in a more complete manner later on But even as it now appears, this map contains a vast amount of valuable information, a great deal of which was obtained by means of the expeditions despatched by the late director of the survey, Dr. G. M. Dawson. So far the western sheet only has appeared, but it is to be hoped that the eastern will soon follow

Canada. **Surveyor-General's Office, Ottawa.**

Sectional Map of Canada. Scale 1 : 190.080 or 3 stat. miles to an inch. Moosomin Sheet (26), West of Principal Meridian. Revised to August 20, 1902. Yale Sheet (93), West of Sixth Meridian. Revised to September 25, 1902. Surveyor-General's Office, Ottawa, 1902. *Presented by the Surveyor-General of Canada.*

The district represented on No. 26, Moosomin sheet, is situated immediately to the west of the western boundary of the province of Manitoba whilst No. 93, the Yale sheet, shows the lower course of the Fraser river, British Columbia, from just above Wellington bar to Sumass lake, as well as the line of the Canadian-Pacific Railway, which follows the river valley.

GENERAL.

World. **Bartholomew.**

The Twentieth Century Citizens' Atlas of the World, containing 156 pages of maps and plans, with an Index, a Gazetteer, and Geographical Statistics. Edited by J. G. Bartholomew, F.R.G.S. London: George Newnes, Ltd., 1902. *Price* 21s.

Although it is only about four years since the first edition of this atlas was published, yet during that comparatively short interval our geographical knowledge has considerably advanced in many parts of the world, and important changes have taken place in the territorial boundaries which have rendered a revised edition a necessity. The above is, however, far more than a corrected edition of the former work, for it has been considerably enlarged and improved by the addition of new maps, of which there are now altogether 156 sheets instead of 120 as before, and by the introduction of fresh letterpress, as well as a most useful index for reference, the omission of which was a great deficiency in the earlier edition. The "Descriptive Gazetteer of the World," which was previously given at the commencement, is still retained, in addition to the new index, and it now appears at the end of the atlas. The more important of the new maps are those devoted to physical geography, and among these may be mentioned the vegetation map of the World and Africa, maps of the World showing mean annual temperature, prevailing winds, and distribution of clouds, population and religious maps of the world, orohydrographical maps of Central Europe, United States, India, and several others. It is perhaps too much to expect that an atlas of this kind should be entirely free from errors, and considering the rapid strides that are being made in exploration and surveying in all parts of the world at the present time, it is almost impossible that the maps should be all up to date; but, taken as a whole, this is certainly a remarkably good and cheap atlas for general reference, and for this purpose deserves to become very popular. The maps are produced in Mr. Bartholomew's usual clear style, although they vary considerably in merit.

World. **St. Martin and Schrader.**

Atlas Universel de Géographie. Commencé par M. Vivien de St. Martin et continué par Fr. Schrader. Sheets: No. 3, Mappemonde; No. 19, Espagne et Portugal, Sud-Ouest Paris: Librairie Hachette et Cie. *Price 2 fr. each sheet.*

Sheet No. 3 contains three maps of the world, the first of which, on the scale of 1 : 75,000,000, shows in hemispheres, heights of the land in six different tints from 200 to 4000 metres, and depths of water in six shades of blue. The effect would have been more satisfactory if, instead of different colours having been used to indicate the relief of the land, shades of one colour, such as burnt sienna, had been employed. There might also with advantage have been greater difference between the shades of blue indicating the depths of the ocean. The great ocean deeps might also have been more clearly brought out. The two other maps of the world on this sheet are on a much smaller scale, and consist of one, on an elliptical projection, showing zones of vegetation and ocean currents, and another, in hemispheres, showing annual rainfall and winds. Sheet No. 19 is the south-west sheet of a beautifully executed map of Spain and Portugal, on the scale of 1 : 1,250,000, of which only one sheet, the south-east, remains to be published. Altogether sixty-two sheets have now been published of the ninety of which the atlas will consist when finally completed, which at the present rate of issue will not be for years to come. A sheet of letterpress accompanies each map, giving the authorities consulted.

World. **Schott.**

Die Verteilung des Salzgehalts im Oberflachenwasser der Ozeane. Von Dr. Gerhard Schott, 1902. Scale 1 : 80,000,000 or 1262·6 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1902, Taf. 19. Gotha: Justus Perthes. *Presented by the Publisher.*

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during September and October, 1902. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
3185 m	= 3·0	Scotland, west coast:—Loch Sunart. 2*s.* 6*d.*
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3301 m	= 7·0	Africa, north coast:—Tenez road and harbour. 1*s.* 6*d.*
3305 m	= 5·75	Newfoundland, east coast, Bay Verte:—Coachman harbour. 1*s.* 6*d.*
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3290 m	= 3·63	Cuba, north coast:—Livisa and Cabonico bays. 2*s.* 6*d.*
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3295 m	= {1·8, 2·9}	Plans on the east coast of South America:—Chubut river, Camarones bay. 1*s.* 6*d.*
745 m	= 0·5	India, west coast. Sheet VIII.:—Netrani to Mangalore. 2*s.* 6*d.*
71 m	= 0·25	Bay of Bengal:—Madras to Calimore point. 2*s.* 6*d.*
3299 m	= 3·0	China, north coast:—Shitau bay and approaches. 1*s.* 6*d.*
2423 m	= 0 25	Papua or New Guinea. Sheet III..—Boigu island to Cape Blackwood 2*s.* 6*d.*
10c. m	=	Arabian coast. Plan added:—Sur anchorage.
1472 m	=	Australia, south coast. Plan added:—Kumbanah bay.
2411 m	=	New Zealand. Plan added:—Entrance to Otago harbour.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.		Cancelled by	No.
2372 Windau Plan on this chart		New plan. Windau	3300
162 Novorossisk bay.		New plan. Novorossisk bay and harbour	162
1766 Tenez anchorage Plan on this chart.		New plan. Tenez road and harbour	3301
428 Ports of Cabonico and Livisa. Plans on this sheet		New plan. Livisa and Cabonico bays	3290
128 Port Tanamo Plan on this sheet.		New plan. Port Tanamo	3291
745 India. Sheet VIII Alvagudda to Mulki.		India Sheet VIII. Netrani to Mangalore	745
1156 South-east promontory anchorage. Plan on this sheet.		New plan. Shitau bay and approaches	3299
1034 Kumbanah bay Plan on this chart.		New plan. Kumbanah bay on sheet	2411

Charts that have received Important Corrections.

No. 2010, England, west coast:—Morecambe bay. 1191, England, east coast:—Flamborough head to Hartlepool. 1210, Ireland, south coast:—Berehaven. 3038, Norway:—Biörnsund to Kristiansund. 565, Iceland, western portion. 2733, Iceland:—Portland to Suefells Jökel. 566, Iceland, eastern portion. 280, Newfoundland:—Notre Dame bay. 2857, East coast of United States:—Potomac river. 424, Cuba:—Port Matanzas. 2344, Gulf of Mexico:—Mobile bay. 550, South America, east coast:—Entrance of the river of Saõ Francisco. 1911, United States, west coast:—Approach to Juan de Fuca strait. 630, British Columbia:—Port Neville, Forward harbour. 759B, Madagascar:—Antongil bay to Ambatosoa. 1270, Korea:—Approaches to Chemulpo anchorage. Chemulpo anchorage. 1065, Korea:—Douglas inlet and Sir Harry Parkes sound. 1203, Japan:—Uraga harbour.

(*J. D. Potter, Agent.*)

North Atlantic Ocean and Mediterranean Sea. **Meteorological Office, London.**

Pilot Chart of the North Atlantic and Mediterranean for December, 1902. London: Meteorological Office. *Price 6d. Presented by the Meteorological Office, London.*

River Mersey. **Belam and Ashton.**

Chart of the River Mersey, from Rock Lighthouse to Eastham and Garston, 1901. Scale 1500 feet to an inch. Henry Belam, Commander R.N., Marine Surveyor, H. G. G. Ashton, F.R.G.S., Assistant Marine Surveyor, Mersey Docks and Harbour Board. *Presented by H. G. G. Ashton, Esq.*

Captain Belam and Mr. Ashton have already produced charts of the approaches to Liverpool and the entrance to the Mersey, containing a large amount of detailed information as regards soundings, the positions of sandbanks, etc., which must have proved most useful to the navigator. They have now issued an additional sheet, showing the course of the Mersey as far as Eastham and Garston. Numerous soundings are given at short intervals, in lines running across the river at right angles to its course, and the positions of lights and sands are clearly indicated.

U.S. Charts. **U.S. Hydrographic Office**

Pilot Chart of the North Atlantic Ocean for November, and of the North Pacific Ocean for December, 1902. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

British East Africa and Uganda. **Pereira.**

240 photographs of British East Africa and Uganda. By Captain C. Pereira, Coldstream Guards. *Presented by Captain C. Pereira.*

These photographs are specially interesting from the fact that they represent the country and natives in their primitive conditions before they are changed by the introduction of civilization, which doubtless will soon be the case, now that the railway has been constructed to Victoria Nyanza. The following are the titles:—

(1, 2, 5, and 6) Uganda railway; (3) Mission station garden, Kibwezi; (4) Ox transport, Uganda road; (7) Group of Masai Elmoran, taken at Kikuyu station; (8) Northern slopes of Mount Elgon; (10) Group of Masai; (11) E. J. Berkeley, H.M. Commissioner and Consul-General for Uganda, and group of officers of Uganda Rifles; (12, 13) Wakikuyu warriors; (14) Group of Masai Elmoran at Kikuyu fort; (15) Kikuyu fort; (16–19) Wakamba porters; (20) Masai people; (22 and 29) Thompson's gazelle; (24) Kibwezi fort; (25, 39, 211, and 225) Captain Pereira; (27) Captain Sykes, R.H.A., issuing rations to Swahili Askaris; (28) Bush cat; (31) Nandi fort; (32 and 33) Camp on the Uganda road, Nandi country; (34–37, 40, and 41) Views in the Mau forest; (38) Clearing in Mau forest; (42) Kavirondo medicine man, Mumia's; (43) "Mgeti," Kavirondo chief, and wives, Samia hills; (44) Wa Kavirondo, Mumia's; (45) Canoes at Lubwa's ferry, Victoria Nyanza; (46–49) Lubwa's ferry and Wa Kavirondo porters; (50) Two years' supply, clothing, provisions, and ammunition; (51) Camp, Samia hills, Kavirondo; (52) Swamp, Uganda; (53) Caravan entering Kampala (Mengo); (54–57) Marching through Uganda, trees, grass, and swamps; (58–61) Views in Usoga; (62) View in Uganda; (63) Native bridge over swamp; (64) Pathway in Uganda; (65) Waganda canoes, Victoria Nyanza; (66) Sore-Mbai gorge; (67–69) Views north of Mount Elgon; (70) Rock pools, Birkimani, South Karamo; (71 and 72) Views of camp at Sare, Mount Elgon; (73) Sudanese troops, Uganda Rifles; (74) Officers of Colonel Macdonald's column; (75 and 86) Karamojo and Shooli natives; (76 and 82) Gule camp, Rom hills; (77) Kabiliolh camp, Karamojo; (78) Mount Moroto, from camp in Bukora, near Mumalinga hill; (79) Camp, Titi, Karamojo; (80) Mumalinga camp, Mount Moroto in distance; (81) Camp near Akinyo river; (83 and 84) Karamojo natives; (85) Camp near Mumalinga hill; (87 and 89) Upper Solian; (88 and 90) Views from upper Solian looking towards Kiteng; (91 and 92) Natives of Solian; (93 and 94) Karamojo headgear; (95, 97, and 99) Katu village, Latuka; (96) Maxim gun porters and Sikhs; (98 and 109) Langu natives; (100) Solian camp; (101) Solian hills from Kiteng; (102) Loggouren village on top of kopje, Latuka; (103) Camp; (104) View up valley leading to Tarrangole; (105, 106, and 108) Tarrangole town; (107 and 112) Langu chief; (110 and 117) Sultan of Latuka and natives, Tarrangole; (111) Tarrangole women; (113) Langu chiefs and Dervish Jibba; (114) Latuka headdress; (115) Zanzibari headmen; (116) Loggouren villagers, Latuka; (118) Native guides; (119) Mohomed Ratib Effendi (16th Co. Uganda Rifles), headman Raschid and Farajalla Effendi (16th Co. Uganda Rifles); (120) Sikhs; (121) Women and girls, Latuka; (122) Camp Titi, Dodosi; (123) Titi; (124 and 125)

Views near Titi; (126-129) Caravan on the march, plains of Karamojo; (130 and 131) Kopjes near Titi; (132) Caravan on the march; (133) Captain Kirkpatrick; (134 and 135) General view of Mount Elgon from the north; (136) Mount Moroto; (137) Mount Debasien; (138) Mount Debasien from the south; (139) Expedition fording Nzoia river; (140–143) Officers serving in British East Africa and Uganda—Bright, Pereira, Austin, Hanbury Tracy, McLoughlin, Macdonald, Fergusson; (144 and 145) Market, Mumia's; (146) Kavirondo women; (147) Rifle range, Mumia's; (148, 149, and 152) Native bridge made of creepers near Mumia's; (150 and 153) Wanyamwezi porters dancing; (151) Kavirondo women, funeral dance; (154–156) Port Victoria, Victoria Nyanza; (157) Natives, Port Victoria; (158) Sentry box, 16th Co. Uganda Rifles, Mumia's; (159) Mess hut, Mumia's; (160) Grass hut over tent, Mumia's; (161) Camp at Mumia's, 16th Co. Uganda Rifles; (162) Ferry boat on river Nzoia, near Mumia's; (163) Cyclist, Mumia's; (164) Mwanga, *en route* to the coast after capture; (165) Kabba Rega, *en route* for the coast; (166) Mwanga and Kabba Rega; (167) Kavirondo warriors; (168) View in Ukassa country, Kavirondo; (169 and 170) Ugowe bay; (171) Akola's, near Port Ugowe; (172) Papyrus, Port Ugowe; (173 and 174) Pier built through Papyrus, Port Ugowe; (175–177) Market, Port Ugowe; (178 and 179) Country between Nandi station and Lumbwa's Post; (180 and 181) View from Lumbwa's Post; (182) Nyando valley, Lumbwa's Post, showing camp; (183) Nyando valley near Lumbwa's post; (184) Lumbwa's Post camp, Nyando valley; (185 and 186) Nyando valley, looking east from Lumbwa's Post; (187) Mnara hill near Lumbwa's Post, Nyando valley; (188) Lumbwa's Post camp, Nyando valley; (189 and 190) Nandi chief; (191–193) Wa Nandi warriors; (194–204) Wa Nandi and Wa Lumbwa, Lumbwa's Post, Nyando valley; (205–208) Uganda Railway Survey Camp, Mau plateau—Christmas, 1899; (209) Railway survey party and Captain Pereira; (210) Uganda Rifles, native officers; (212) Some N.C.O.'s, 16th Co. Uganda Rifles; (213) Quarter guard, 16th Co. Uganda Rifles; (214–216) Sections of s.s. *William Mackinnon* being carried to Victoria Nyanza; (217–221) Lake Naivasha; (222) Naivasha fort; (223) View from Naivasha fort; (224) Mount Longonot rift-valley; (226–229) Uganda Railway railhead, January, 1900, Kikuyu escarpment; (230) Mombasa; (231) Mombasa, road to the railway station; (232) Bungalow, Mombasa; (233) Kilindini harbour, Mombasa; (234–238) Zanzibar; (239 and 240) Dar es Salaam.

Fernando Noronha. ——

Fifteen photographs of Fernando Noronho. *Presented by R. Kaye Grey, Esq.*

These photographs were taken in connection with the landing of the South American cable, with which event several of them are specially concerned. In addition to this, they illustrate very clearly the physical features of the island.

(1) The fort; (2 and 3) The Peak rock; (4) The Peak rock and Fair Brother's rock; (5) The Peak rock, "Caporro" beach and infirmary in foreground; (6) Government offices and cable station; (7) General view of "Villa" (town); (8) South American Cable Company's cable-huts; (9) Landing the South American cable from s.s. *Silvertown;* (10 and 11) Conceicão beach; (12) The "Praca;" (13) General disembarking place, "Caporro" beach; (14) Landing South American cable, Conceicão beach; (15) s.s. *Silvertown* off Fernando Noronha.

Lord Howe Islands. **Brown.**

Nineteen photographs of Luanua, Lord Howe islands, taken by Rev. George Brown, D.D. *Presented by C. M. Woodford, Esq*

Dr. Brown is to be congratulated on these excellent photographs which he has succeeded in taking of this comparatively little-known group of islands. Those of the natives and the native burial-grounds are remarkably good, and the latter are specially interesting.

(1-4) View in village, Luanua; (5) Sacred house containing wooden images, Luanua; (6) View at Luanua; (7–9) Native burial-ground, Luanua; (10) "Uila," chief of Luanua; (11-18) Natives of Luanua; (19) Natives of Luanua (with albino woman).

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

The

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EXPLORATION IN WESTERN CHINA.*

By Captain C. H. D. RYDER, R.E.

In November, 1898, I was fortunate enough to be attached by the Government of India to an expedition under Major Davies, of the Oxfordshire Light Infantry, to explore, carefully map, and report on the province of Yunnan, in South-Western China. After seven months' wanderings we returned to England, and again entered the province in November, 1899. This second year, having completely surveyed the more important portions of Yunnan, we extended our journey into the province to the north, Sechuan and Chinese Tibet, finally reaching Shanghai, down the Yangtse, in July, 1900, just at the time of the troubles in Northern China.

From a geographical point of view, the most interesting feature in Yunnan (*vide* map) is the extraordinary number of large rivers which flow through or take their rise within the province. Commencing on the west, we find many affluents of the Irrawadi, though the main river is situated in Burma; next comes the Salwen, entering from the unknown in Tibet, flowing nearly due south, until it enters Burma, and forming in places the boundary between Burma and Siam, finally reaches the sea at Moulmein. Then we have the Mekong, entering the province in a similar manner to the Salwen, also of great use as a frontier line first between Burma and China, then between Burma and French territory, and finally between the latter and Siam; it is a river

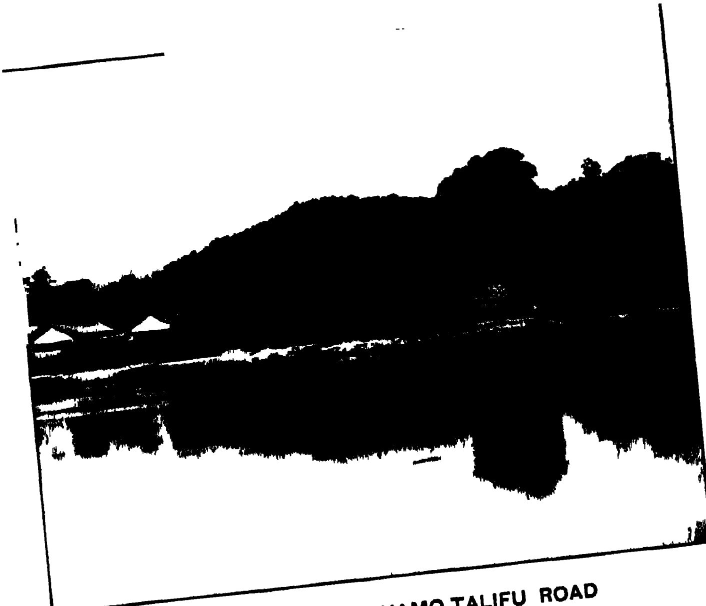
* Read at the Royal Geographical Society, November 24, 1902. There is so much new work to be incorporated in Captain Ryder's map that it will not be ready for some time In binding it should be inserted at the end of this number.

which has a great fascination for French explorers, who have done much towards mapping its course. Thirdly, and most famous, flows the Yangtse, at first parallel to the other two, but near Tali-fu it takes a great bend due east, then another due north, leaving room for the plateau from which the Red river of Tongking and the West or Canton river take their sources.

On this plateau lie the majority of the seventy-odd cities of the province, some in reality mere villages, others large towns, but all have the official rank of city, and all, with one exception, are walled. The exception is Li-chiang-fu; on my inquiry as to the reason it was not walled, I was told that it was because there was no high military official there. Now, each of these cities lies in a plain; in the east, where the plains are larger, two or more cities are found in one plain, but no city exists where there is no plain, the consequence is that these plains, although they do not bulk large on a map, are far and away the most important portions of Yunnan, both politically and commercially. They vary in size, a very common one being 8 miles by 2 or 3; and are entirely populated by Chinese, who have the faculty of keeping the best of everything for themselves, pushing the earlier inhabitants, such as Lolos and Shans, into the hills and into the deep and feverish valleys.

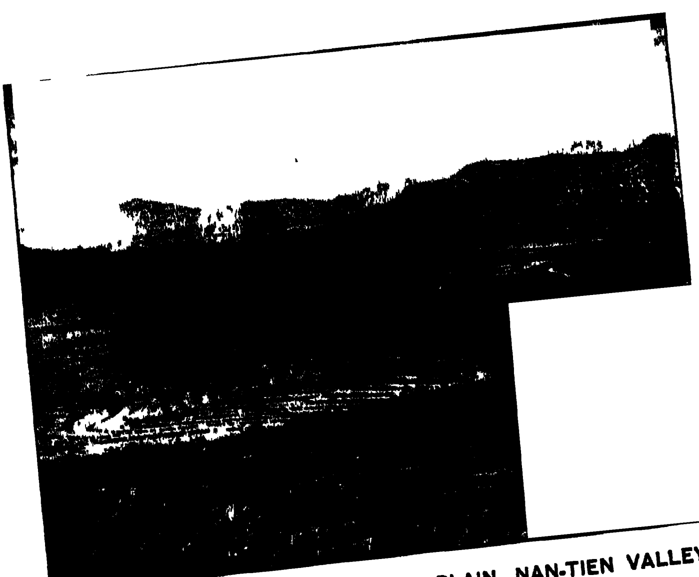
We made our start from Bhamo, and, marching up the valley of the Taeping river, crossed the frontier after two marches, and commenced surveying. On our first march in Chinese territory we had to pass several small stockades, and I was rather doubtful whether the Chinese soldiers might object to our surveying. However, I was soon relieved, as I found my Indian surveyor had put up his plane-table close to one of the stockades, and was calmly surveying, while the garrison of one man, armed with a pipe and a long spear, was gazing at him with awe and surprise.

Of the country before we went into it very little was really known; travellers there had been in plenty, but only a few of them, notably Captain Gill and Mr. Baber amongst English, and M. Garnier and Prince Henry of Orleans amongst French, had made any attempt at real surveying. Major Davies had, however, in 1895, done a lot of work in the western portion of the province. We also had a Chinese map, which must originally, as constructed by the Jesuits, have been a very good one, but many editions in the hands of the Chinese printers had gradually spoilt it, and, except in the matter of giving us the correct names of the towns, it proved worse than useless. The trouble we took over our surveying was always a source of wonder to the Chinese. The country had gone on very well for hundreds of years without maps, what was the good of them now? They thought us idiots, but let us survey without let or hindrance, so we did not trouble ourselves much about their opinion.



FIRST STAGE ON BHAMO-TALIFU ROAD

(From a photograph by Capt Ryder)



REMAINS OF ANCIENT LAKE BED PLAIN, NAN-TIEN VALLEY.

(From a photograph by the late Capt. Watts-Jones)

The villages in the Taeping valley are inhabited by Shans, and are so surrounded by bamboos that the houses are scarcely visible from outside. This valley is thickly populated, and is a promising line for a railway as far as Momien, though it could never be extended beyond that town. We also met with our first chain suspension bridge, a kind of bridge of which the Chinese are very fond; they make them well, but do not keep them in repair.

In Momien we had our first reception from a hostile crowd. As soon as we entered the town late one evening, a mob collected; only insulting at first, they presently began stone-throwing, and we all got hit several times. Our baggage had arrived ahead of us, and we did not know where it had gone to. As the crowd got larger, the stones got larger too, and the matter looked decidedly serious, when, fortunately, an extra large stone hit Major Davies on the funny bone. This gave the necessary fillip, and away he went straight into the crowd, followed by Captain Watts Jones and myself. The crowd fled so fast we only could each get home with our sticks on one head; unfortunately for the owner, it was the same head in each case. As soon as we turned again the crowd reassembled; we accordingly had to execute two charges more before we finally got into a temple in the official's quarters. Two ragged soldiers then appeared. They did not look up to much; however, they represented authority, and the crowd dispersed.

Next day the town was quiet, and the official, in a fright lest we should report him, was very polite. We accordingly went out to see a very fine waterfall, over which the Chinese threw five hundred Mahommedan prisoners at the close of the Mohammedan rebellion. In considering the history of Yunnan, it really is unnecessary to go further back than this rebellion. For many years, while the Chinese Imperial Government were fully occupied by the Taeping rebellion, the Mohammedans made great headway, most of the province falling into their hands. When the Chinese got to work, they swept the Mohammedans out of the country, only a few escaping to Burma, where, under the name of Panthays and under our protection, they have thrived wonderfully; but to this day half-deserted towns and ruined villages bear silent witness to the devastation created by this rebellion. Yunnan has not yet recovered from its effects, though thirty years have passed since its close.

At Momien and four other towns where there were telegraph stations I was able to obtain accurate longitudes by time comparisons over the telegraph wire with another officer at Bhamo. This is work that requires great accuracy, any error in seconds of time being multiplied fifteen times in seconds of distance. The observations at my end were carried out under difficulties. I used to slink down at dusk to the telegraph office, in order to avoid attracting a crowd, only

to find that the telegraph clerk had invited a select party of friends to watch the performance; they generally meant well, but it is somewhat trying, while engaged on delicate astronomical observations, to overhear remarks on one's personal appearance which were never flattering.

This telegraph line was, however, a great friend of ours, as it was for months our only means of receiving news of the outer world. The clerks only knew a few words of English, but they knew the English letters. The line is never used for through traffic; the probable time it takes for a message from Rangoon to reach Shanghai is about ten days, as the line is continually interrupted.

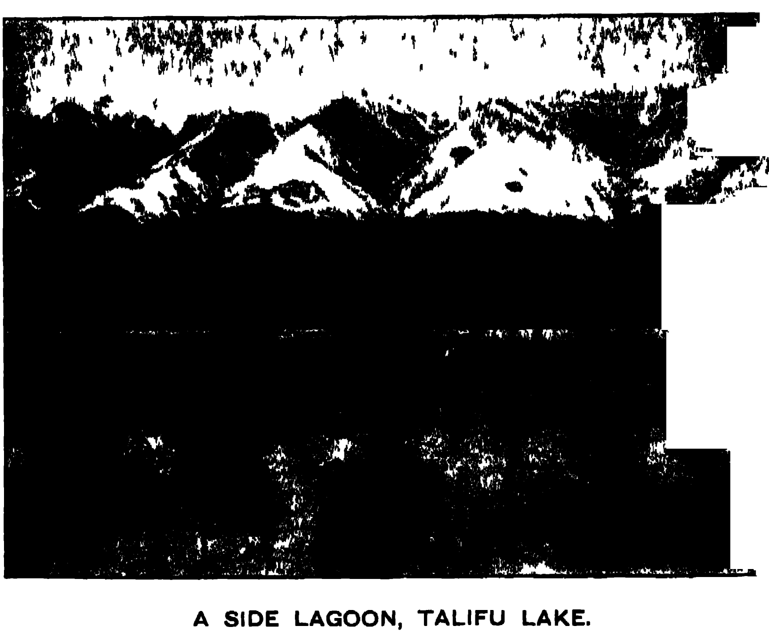
While Major Davies now kept up to the north of Momien, Captain Watts Jones and I went south to the Nam Ting valley to examine into the possibilities of a railway line. By surveying the main and side valleys it was soon obvious there was only one possible line; and this line, which Captain Watts Jones followed through up to Tali-fu and so on to Yunnan-fu, is the only through line into China from Burma that can ever be constructed.

In this matter of railway communication a great deal of hopeless ignorance of the country has been displayed, when we come to look at the various proposals that have been seriously put forward, and because our Government did not at once support these proposals, they (the Government) have been unwisely criticized. The first suggestion made was for a railway up through Siam and up the Mekong valley. This may at once be dismissed as impossible; the Mekong is a river which runs in deep gorges, with no inhabitants but those in a few miserable hamlets. When we come, however, to consider the question of a line from the Kunlong ferry up the Nam Ting valley, we once more enter the regions of possibility; and the Yunnan Company did a very public-spirited action in originating our expedition, while the Government of India showed their anxiety to obtain more reliable information, and getting the country well surveyed by attaching to the expedition several good native surveyors as well as myself. Any railway experts who discuss this question with our maps and reports before them are, at any rate, basing their opinions on reliable data. In a paper before a Geographical Society, it is, I consider, out of place to discuss the advantages and disadvantages of building this line. As the French are at present constructing their line from Tongin to Yunnan-fu, this question of railways in Yunnan becomes a political one.

There is no doubt a great future lies before the whole of China, in which Yunnan will not be behindhand, owing to its proximity to English and French possessions, to its richness in minerals, and to the fact that, while Burma and Tonkin are low and feverish, Yunnan rejoices in a splendid climate, due to the high elevation at which most of the towns lie. There is, however, every variety of elevation. In the north-west corner the three large rivers flow at a height of 7000 feet

CANAL NORTH OF TALIFU, CONSTRUCTED DURING THE MING DYNASTY.

(From a photograph by the late Capt. Watts Jones.)



A SIDE LAGOON, TALIFU LAKE.

(From a photograph by the late Capt. Watts Jones.)

above sea-level, with ranges of 20,000 feet and upwards intervening; they leave the province at elevations nearer 1000 feet. The cultivated plains all lie between 5000 and 8000 feet above sea-level.

Every one who has travelled in China finds the curiosity of the Chinese inexhaustible. It forms, perhaps, the most unpleasant part of a traveller's experience. In any of the town inns it is almost impossible to secure privacy, even in one's own room; sometimes a crowd would be insulting, but more often simply curious.

Until reaching the neighbourhood of Tali-fu, the only Chinese town of any importance is Yunchau, still mostly inhabited by Mohammedans; we therefore had quite a cordial welcome. It was one of the last towns to hold out in the rebellion; and my interpreter, whose old home it was, when twelve years of age, had escaped to Burma with his father when the town fell into the Chinese hands. He had only one failing, and that was drunkenness. He had three different stories of how he escaped, no one bearing the slightest resemblance to the others, and I could always accurately gauge his degree of drunkenness by asking him how he escaped from Yunchau, and waiting to see which story he would tell me. In other respects he was a splendid fellow.

In the matter of cultivation the Chinese generally are past masters. They display a wonderful amount of ingenuity in terracing their fields, and in their aqueducts and irrigation channels. Two crops are grown annually in Yunnan on most lands: the first, taking advantage of the rainy season, is usually rice; the second, wheat, opium, and peas or beans in about equal proportions. There are, of course, other crops, but these are the most important. In the neighbourhood of every village are numerous vegetable gardens, even the poorest mule-driver or labourer insisting on some vegetable with his rice, if he cannot afford pork. Should a railway be constructed connecting Burma with Yunnan, a large trade would arise in food-stuffs, crops preferring a cold climate such as exists on the uplands of Yunnan being exported to Burma, while rice would be sent up from the low-lying lands of Burma into Yunnan. At present no such trade exists, owing to the very expensive means of transport. A few rough carts exist in the eastern portion of the provinces, but the roads are bad and only exist for short distances: the bulk of the carrying-trade travels on the backs of mules, which is, of course, a method not suitable for the transporting of bulky food-stuffs over any but very short distances. Should there be, therefore, a failure of crops, a famine arises, and the inhabitants of that particular district have to shift for themselves.

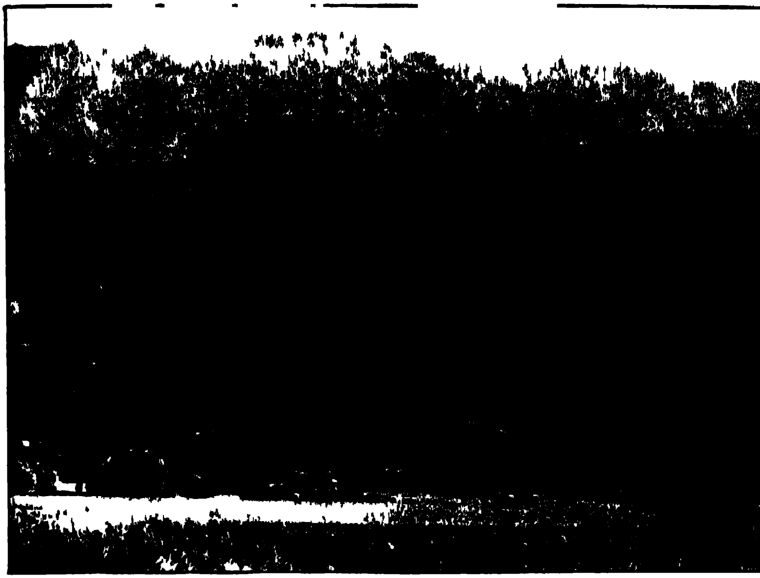
Salt is the one article of food which is carried long distances. It is supplied from several salt-mines in different parts of the province; each mine is told off to supply certain districts, and very heavy are the punishments dealt out should the inhabitants of any district be found dealing in salt other than that from the district mine. Salt

forms one of the largest sources of revenue to the provincial government, and hence also to the officials. Any appointment connected with salt is therefore eagerly sought after, and the pockets of the officials connected with the mines must be protected even if it entails on the wretched villager the necessity of importing his salt from a distant mine instead of a near one, thus paying double or treble what he would otherwise have to do.

To follow my journey once more. I had to cross the Mekong by a ferry, and, crossing a wild mountainous tract of country, reached the town of Ching-tong-ting. Here I first met English missionaries, and it is not out of place to record here my warmest thanks for many a kindness and help I received from them throughout my journeys. People may differ in opinion as to the value of their work, but I maintain that they are doing a very great and noble work, and are of the utmost use in the matter of accustoming the Chinese to European customs and ideas.

Proceeding northwards towards Tali-fu, we passed amongst Lolos. It is difficult in any country to decide who are the real aboriginal inhabitants; it is more than likely that the Lolos may claim to be so for South-Western China. They have now been driven by the Chinese into the hills; but in parts of Sechuan they are still quite independent, and no Chinese dare enter their villages. They are much handsomer to our eyes than are the Chinese. On my arrival at Tali-fu I met Captain Watts Jones, and together we travelled north to the Yangtse. Many travellers have described Tali-fu. The lake is some 30 miles long, and 5 to 7 miles wide. On the eastern shore low reddish hills rise straight from the waters, but on the western side a slightly sloping and well-cultivated plain runs back a couple of miles to a very fine range, which reaches a height of 14,000 feet, the lake itself lying at an elevation of just under 7000 feet. Snow is found all the year round in sheltered spots on this range, while in winter it falls and lies down to the level of the lake. There is very good duck-shooting, particularly at the northern end, which is somewhat marshy. I cannot conceive a more ideal hill-station or sanatorium for fever-stricken Europeans from Burma or Tonking; but Yunnan abounds in such spots. The plain at each end of the western side of the lake is closed by an old line of fortifications, which are now, of course, useless. The lake drains into the Mekong by a rapid-running river, which in one fine gorge is jammed into a width of 3 yards; what the depth is no one knows.

As we went northwards the general elevation of the country increased, and the country became more Tibetan in character. We were on the main road to Batang and Tibet, the road that Captain Gill had travelled over. It was here we passed by a very fine canal constructed during the Ming dynasty, and also several very fine stone



CHINESE SHAN VILLAGE IN TAEPING VALLEY.

(From a photograph by the late Capt Watts Jones)

THE NAIN TING VALLEY.

(From a photograph by the late Capt Watts Jones)

bridges. They were much more level than usual, and easier to ride over; an ordinary Yunnan stone arch bridge being so high in the centre that to ride across one is much like riding up one side of the roof of a house and down the other. All these bridges are built either by private individuals, as a "work of merit" to be put to their credit hereafter, or by the various guilds of merchants who use the road. The Chinese Government never troubles itself about such trifles as roads and bridges, or public works of any kind; and no official would push through any necessary work unless he saw thereby a means of obtaining a satisfactory squeeze.

This Chinese idea of a "work of merit," though sometimes misplaced, as when they spoil a good path by paving it with cobbles and then never repairing it, is undoubtedly one of the best points in the national character. I shall always remember one instance I met with. On a path which I had to cross in the early winter, on the range between the Shweli and Salwen, I came across a small hut in which were two old men. We had been struggling up through the snow, which lay over 2 feet deep, and were fairly exhausted when we reached the top. We gladly accepted the invitation of the two old men to enter their hut and enjoy a cup of tea and a warm by their fire. There had been four of them, but two, who had given a bowl of rice and a pair of grass sandals to passers-by, had died. We offered payment, but it was refused—they would only accept our thanks; and we hurried downhill into a warmer valley with a grateful corner in our hearts for our two old hosts.

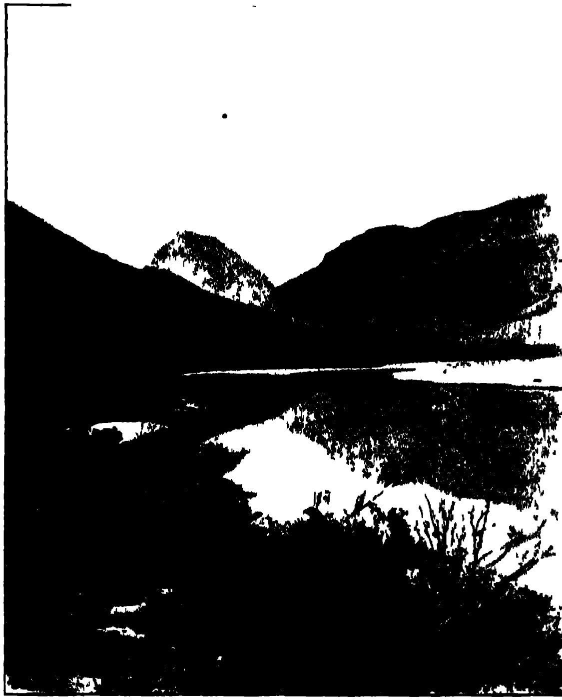
We reached the Yangtse at Shih-ku, where Gill left it. There is a very fine stone drum here, put up to commemorate a Chinese victory. Turning east, we passed through Lichiang-fu, leaving a magnificent snow range to the north. In order to get round this range the Yangtse makes a great northern bend. The Chinese maps had placed the northern limit of this bend some 60 miles too far south. Mr. Amundsen, a missionary, and M. Bonin, a French traveller, had noticed this, but the sketch-map which Mr. Amundsen gave Captain Davies was so inaccurate in other points that I for one did not believe that the bend extended so far north, till the following year I camped at the top of the bend myself, observed a latitude, and was satisfied. This is a good example of the value of accurate surveying.

Separating from my companion, we each made for Yunnan-fu by different routes. I crossed the Yangtse again by a fine suspension bridge. The roadway of planks was, however, in a very bad state—many planks were missing, and others rotten; I went across in fear and trembling, and was glad to get across. I was followed by two little Chinese boys, who chased each other as they came across, showing that their heads were better than mine. My mules picked their way across in a wonderful manner, encouraged by the shouts of their drivers

and the tinkling bell on the neck of the leader, who headed the procession across the bridge. We all met again near Yunnan-fu, where we had a snowstorm at the end of March. While the rest of the party went northwards towards the Yangtse, I waited for a month, trying to get a telegraphic longitude with Burma, but entirely failed. When the telegraphic line was not broken, the instruments would be out of order; when they were repaired, a clerk at some intermediate station would absent himself, and disconnect all the wires. Mr. Jansen, a Dane, who had actual charge of the telegraphs in the province, must have had a most trying time. The real head was a Chinese official, who had, of course, no knowledge whatever of telegraphs. His two previous appointments were district judge and in charge of the arsenal: of this latter job he also, of course, knew nothing. I hope he was a good judge. This is a good instance of how Chinese officials are appointed for their own advantage, and not for the good of the country. After leaving Yunnan-fu, I surveyed as much country as I could in a month, reaching the French frontier just as the rainy season commenced. During this season, from the end of May till September, trade is at a standstill, as most of the paths are impassable, and it is a very good time for travellers to quit the country; in October the country is still recovering from the rains. We entered Yunnan early in November, as soon as the roads were open and the cold weather had commenced. The hot weather commences generally in March, but we never found the heat oppressive except in the valleys. The greatest cold I registered was 17° Fahr. below freezing-point, in February, at an elevation of 7000 feet.

Having completed our season's work, I came out down the Red river through Tongking, with nothing worth recording except the great kindness and hospitality I received from French officers wherever I stopped on my way down.

Although we had accomplished a good deal of work, much still remained to be done. Accordingly, Major Davies and I started again in November, 1899, and for three months we surveyed the remaining important routes, avoiding as far as possible going over roads which we had already surveyed, but connecting with our previous surveys whenever we could manage it. One incident, though I laughed at it at the time, seems curious now by the light of later events. One day, on the march, I met a Chinese coolie whom I had employed to carry my theodolite the previous year. We entered into conversation through my interpreter, and presently I dropped out of the conversation, and the two conversed in low whispers. When they had finished I inquired what the man had been saying. "Sir," he said, "take my advice —get out of China as quick as you can. This year will be a bad year for foreigners in China." This was in January; the troubles in North China commenced in May.



YANGTSE RIVER AT SHIH-KU.

(*From a photograph by the late Capt Watts-Jones.*)

RICE TERRACES, SHUNNING FU VALLEY.

(*From a photograph by the late Capt Watts-Jones.*)

I arrived in Yunnan-fu on the same day that Major Davies reached Pu-eh-fu. This was by arrangement, in order to connect these places by a telegraphic longitude; then, while Davies moved up to Yunnan-fu, I marched by a roundabout way to Tsu-hsiung-fu, which was the last telegraph office I had succeeded in connecting with Burma the previous season. By simultaneous observations at these two places we completed our longitudes. We then by separate routes crossed the Yangtse into Sechuan, and headed north-west into Chinese Tibet. The officials, after protests that they had never heard of the places we wanted to go to, and that there were no roads there, and anyhow the roads were infested by robbers, let us go on our way. Our escort gradually dwindled away, then finally disappeared, and we were allowed to find our way westwards as best we could. There is little or no sign of Chinese authority in these semi-independent states. From Yunning a young lama was sent to guide me to Chungtien; even with his help I did not find the inhabitants very hospitable. Our lama would arrange for us to put up in a headman's house; the owner would say, "Stay, by all means, but there is a much better place a mile or so further up the valley, which will just suit you." On we used to go, to find no house at all of any kind. Having been tricked twice in this way, I knew better, and stayed in the best place I could find towards evening. Major Davies and I had agreed to meet on March 27 at Atuntzu. We had not expected that the snow would lie so deep on the passes, and on the 26th, when 22 miles from Atuntzu, I found myself blocked by snow, after making only 4 miles progress in two days. I was also in difficulties as to foot-gear, the most important part of a traveller's equipment. I had started with three pairs of boots, but some scoundrel had stolen a bag the day I left Bhamo, which contained, amongst other things, two right-foot boots. In two months I had nearly worn out my one pair, and then took to wearing Chinese sandals; these were, however, utterly unsuited for snow, and later on we all wore Tibetan boots. On the 27th, thinking Major Davies might be waiting in Atuntzu, I got a Tibetan guide, and with one of my Chinese coolies, by starting at 5 a.m., reached Atuntzu at 7 p.m., only to find Major Davies not there. I put up in a little house, where I was made most comfortable, rested the following day, as my men were suffering from snow-blindness. Returning to my camp in two marches, I met Major Davies on my arrival. He had met with worse snow than myself. Fortunately, a caravan went up the pass that day and trod down a path, which we followed next morning, and with great difficulty and the loss of two mules we managed to reach Atuntzu, where Major Manifold, I.M.S., joined us a few days later, and completed our party. We now sent back to Burma our spare baggage, surveyors, and Chinese followers, and started for the headwaters of the Irrawadi, following at first Prince Henry of Orleans' route. We were, however, stopped by the

snow in the pass leading from the Mekong valley to the Salwen; and as all passes westwards were in a similar condition, we spent a month usefully in marching up to Bat'ang and then down south again to Yerkalo, where we made our second attempt. This time we were stopped in a more exciting manner: our hovering about had put the Tibetans across the frontier on their guard. We reached the Mekong late one evening at the site of a rope bridge. These bridges are simple. A single rope runs each way across the river, the starting-point being higher than the point of arrival; on this are small wooden runners, to which the passenger or baggage is attached. On letting go, one's own weight carries one across.

We secured four small runners, and crossed ourselves, two servants, three Gurkhas, and some of our baggage; unable to obtain larger runners, we could not cross our mules, so left our remaining four Gurkhas to guard them. On our bank there was a small house, from which the hillside went towering up above our heads. We did not anticipate any trouble, as we were in Chinese territory, but while we were having dinner, we heard shouts from the further side; running out to see what was up, we went straight into a band of about twenty lamas, who had crept down and cut the rope by which we had been crossing. After a short rough and tumble they cleared, leaving, however, one of our Gurkhas very badly wounded—his head laid open with a stone, and a gunshot wound in his mouth. We had an exciting watch that night; expecting an attack, we made a barricade of sacks of salt. However, no attack was made, though we heard talking most of the night on the hillside.

Next morning, while we were trying to get one of our mulemen across to act as interpreter, the Tibetans, numbering about 400, lining the hillside above us and the spurs in front and behind, opened fire. This did no damage, and after firing an hour, to which we made no reply, a deputation was sent forward asking us to retire across the river. Encumbered by our wounded Gurkha, and unable to get our mules across, this was the only course open to us. As soon as we agreed, they came forward and, in a most friendly way, helped us to get across. Major Manifold's bedding fell off the rope in mid-stream, but the Tibetans fished it out of a backwater.

It being now too late in the year to make any further attempt to get across into the Salwen valley, owing to the imminence of the rainy season, we made up our minds to strike across Tibet to Tachien-lu, and so on to the Yangtse. The first part of our journey took us about a month, and a very rough time we had. Each pass we crossed cost us the lives of some of our mules, one of our Gurkhas was drowned in the river at Litang, and we were all fairly worn out when we reached Tachien-lu. The Gurkha who was drowned had been with me for over six months; they had all served us, as Gurkhas always do, faithfully and

well. Stolid little men! On the evening of the death of his comrade, the havildar came and saluted to make his nightly report, "All correct, sir, except one rifle, twenty rounds of ammunition, and one private soldier lost in the river." Another man, Maidan Singh, did me good service. One night I had dropped off to sleep, after having had fever all day, when I was awoke by a frightful row in the inn yard. Stepping out to see what was up, I found my mulemen engaged in an ugly fray with some other Chinese. Maidan Singh was standing by my side. "Maidan Singh," I said, "I had just got to sleep, when these scoundrels woke me with their noise." "Sahib," he said, "it is a very great shame." With that he went straight at the Chinese with a short heavy stick in his hand, knocked one senseless into the pig's trough, and drove the others out of the yard. Shortly after, as I was going to sleep again, I heard Maidan Singh alternately cursing the man in Hindustani for disturbing me, and, in very broken Chinese, trying to persuade him to drink some water, and soothing him.

Six very rough marches brought us to Yachau, meeting continuous streams of coolies carrying enormous loads of tea for Tibet, one man particularly carrying at least 350 lbs. and doing daily marches. We then floated 60 miles down stream on a raft to Chia-ting-fu, where we changed into a boat. Just as we were leaving, we received a message from a missionary at Yachau that he had received a telegram to the effect that the legations at Peking were being besieged, and that there was a general massacre of Europeans going on throughout China. This was cheerful news; we were nine armed men, and had some 1800 miles' river journey before we could reach Shanghai. Five days in this boat took us to Chungking, the only noticeable incident being that news of our coming had evidently been sent on by the officials, and at each town we passed, where our escort of two Chinese soldiers was changed, a boat was waiting in mid-stream, enabling us to change our escort without having to land, obviously to keep our passage down river unknown to the general populace. We approached Chungking, an enormous town, with an unpleasant doubt as to our reception. However, we found the situation there fairly satisfactory. The English Consul thought that we might escort the women and children down river, but after several days' delay, only two families could be persuaded to come. We reached Ichang down the Yangtse gorges without mishap, and from there our journey by steamer was simple.

Our journeys in China differed from most previous ones in that we were primarily surveyors; we have, therefore, been able to produce accurate maps of nearly the whole of Yunnan. We have so surveyed and examined the province that in future any one interested in the subject of railways in that part of the world can bring forward proposals based on better information and with more detail than the well-known consul in *San Toy*, who applied to a Chinese official for a

concession for a railway with a school atlas in his hand, saying, "Your Excellency, we propose to build a railway from here to there, with a tunnel here and a bridge there, a viaduct here and another tunnel there."

Before the reading of the paper, the PRESIDENT said: We have with us this evening one of the members of the survey party who has been exploring the province of Yunnan in China, a very interesting and valuable piece of work, and I feel sure that the paper he is about to read to us, with its illustrations, will be interesting. I now call upon Captain Ryder to read his paper.

After the reading of the paper:—

Major DAVIES: Having had the pleasure of being associated with Captain Ryder in two years' exploration work in Western China, I should like to say how very much our expeditions are indebted to the work done by Captain Ryder and by the native surveyors of the Survey of India who worked under him. I should also like to say a few words about the proposed Yunnan railway which Captain Ryder referred to. I think it is a scheme about which there has been a good deal of misapprehension, and on which a great many hasty judgments have been passed, based on very insufficient information. There have been several travellers in Yunnan during the last thirty years, many of them very clever and capable observers, and their opinions have been naturally much sought after by those interested in this subject; but I think it must be remembered they did not go out to Yunnan primarily for the purpose of investigating railway schemes, and it was not their special business to test the feasibility of a railway line through Yunnan. Also in some cases they have expressed opinions which have been very widely held, which really have nothing whatever to do with the proposed line. For instance, Mr. Baber of the Chinese Consular Service, whose writings combine in a marvellous manner the amusing and the instructive, makes two remarks which have been very much quoted. Speaking of the very high range between the Salween and the Shweli, he says, "If British trade ever adopts this track, I shall be delighted and astonished in about equal proportions." Further on, when discussing the subject more generally, he says, "By piercing half a dozen Mont Cénis tunnels and erecting a few Menai bridges, the route between Burma and Yunnan Fu might doubtless be very much improved." These two remarks, I think, have had great influence on people who have not studied the subject very deeply, and have induced them to think that the railway scheme is quite impracticable. I quite agree with the truth of both these remarks of Baber's; the only thing is, they do not apply to the railway at all—they refer to the road which goes westward from Momien through Ta-li-fu, whereas the present proposed railway comes into Yunnan from quite a different direction. Indeed, only half a page lower down Baber himself recommends as a probable line for a railway the very route which has now been adopted. To quote another instance of a rather poor argument against this railway. In a book, published as lately as last year, which devotes a chapter to the subject of railway extension from Burma into Yunnan, I came across the astounding statement that no coal has been found in Yunnan. Now, as a matter of fact, coal exists almost all over the province, and there are many large districts of Eastern Yunnan in which hardly anything is used for fuel but coal, which is all obtained from local mines. Of course, I quite understand that there may be differences of opinion as to the commercial value of a line through Yunnan, but I hope, in future, opinions will not be based upon misapplied quotations or upon such very inaccurate information as that which I have just quoted.

As to the work we did in Western China, the most important part of it is undoubtedly the preliminary railway survey which was carried out by Captain Watts Jones and Captain Hunter, both officers of the Royal Engineers. Captain Watts Jones, I am sorry to say, lost his life afterwards in the cause of exploration in China. The line they surveyed certainly presents great difficulties, but it is a practicable line that could be made. Besides the actual survey, the other members of the Expedition split up and took different routes, so as to get in as much work as possible, and made a fairly thorough exploration of the province of Yunnan. Of the eighty-four official cities of Yunnan, we visited all but three; so I think we may claim to have some knowledge of the province and of its resources. As to the mineral wealth of Yunnan, I do not think there has ever been any doubt. We certainly came across mines everywhere, and all sorts of mines—gold, silver, lead, tin, iron, copper, zinc, coal—and even with the present poor appliances that the Chinese have for working these mines, they make them pay. To give an instance of the sort of way in which they work their mines, one of our party who visited a gold-mine found them crushing the quartz with a sort of large wooden instrument, which is used in that country for husking rice. This was the only appliance they had for crushing gold quartz. The agricultural resources of Yunnan, too, are not to be altogether despised. Earlier travellers saw the province when it was just recovering from the effects of the Panthay rebellion, and I think all the members of our expeditions have at different times remarked to me that the poverty of Yunnan has been much exaggerated. As to whether this line will pay, it will be still rather an open question; but I think the Yunnan company, with the assistance of experts on matters of this sort, will now be able to decide whether it can be made as a commercial speculation or not. I regret that I cannot enter fully into the pros and cons of the Yunnan railway, as the question is largely a political one which cannot be discussed before this Society. There is, however, one suggestion about railways that I should like to make, and that is, that, as a beginning of railways in Western China, a line should be made from Chung-king or some other point on the Yangtse up to Ch'êng-tu, a very large city, the capital of Sechuan. This is a line that was originally proposed and surveyed by Captain Watts Jones, who had a high opinion of it, and thought it was a line that would pay at once. His opinion has now been endorsed by Major Manifold, who, with Captain Hunter, has lately been making some very thorough surveys through the whole of Central and Eastern Sechuan, and, if I might be allowed to suggest, I should say that would be the line that should be the first to be made of the railway lines in Western China. That once made, I think extensions of it would follow very easily. Sechuan is nothing like as hilly a province as Yunnan, and it is a very rich province. It is certainly the largest and most populous province in China; it is also considered the richest. I think, by beginning there, it would give the promoters of the scheme an idea of what railways in Western China would turn out like. And eventually it might be carried from there backward through Yunnan. The Yunnan railway is a very large business, and its construction may be delayed, but I cannot help thinking that a line which makes a great highway between India and China will eventually become an accomplished fact.

Sir THOMAS HOLDICH: It is little that I can add to this interesting paper that we have heard to-night about a country in which, unfortunately, I have never travelled myself. But I am glad of this opportunity to welcome an officer from the department with which I was so long associated in India, who, more fortunate than his brother officer and survey comrade, Captain Watts Jones, has returned here to England to tell us the story of what he did in that distressful country,

China. There are one or two points that have struck me in relation to his work. In the first place, the extent of it, and, in the next place, the energy with which it was carried through. I think that if we remember back not so very long ago —well, within my memory—as to how much we knew of those countries which lie beyond the borders of India, we shall be struck at once with the immense extent in late years of those geographical surveys which have been carried out on scientific lines in the same manner that Captain Ryder with Major Davies have carried out their surveys in Western China. I can remember the time when the rugged line of frontier hills beyond the Indus not only bounded our horizon in that direction, but was absolutely at the time the limit of our geographical knowledge. We knew a little of what lay beyond them, but of what was in them we knew nothing. We knew something of the passes and the roads that ran through them, but of the hills themselves and of the villages we knew nothing. All that country where the present campaign is being carried on was an absolute blank. And now, how is it at present? We have carried these geographical surveys well into Eastern Persia, we have carried them to a junction with Russian territory on the north; and now, thanks to Major Davies and Captain Ryder, they extend well into China on the east. And yet, as Captain Ryder has told you, there is a very large future before us. We cannot say that we are within anything like measurable distance of the end. There is a large future for work of this nature; but the success of such survey work—the success of Colonel Rennie Taylor and Captain Ryder lately in another field in China, and of Major Close and Captain Janson in the Transvaal, and of other officers whom I could mention in other parts of the world, all working on the same system—should, I think, at least assure us that that system is a sound one, and may safely be commended to the consideration of those many half-developed institutions which are rapidly springing up in England in the cause of geographical education. We were all much interested, of course, in hearing what Major Davies and Captain Ryder had to say about the chances of the connecting link between Burma and China in the matter of railways, and it is quite clear, I think, from what they have said, that, in their opinion at any rate, the engineering difficulties are not insurmountable. But they have said nothing about that larger question, which probably will interest the public very much in the future, as to whether it is not rather competition than construction which will bar the way to that connection ever being practically useful; whether the great waterways of China, which you have seen pretty well shown in the map which Captain Ryder has placed on the screen, whether that magnificent system of waterways and the easy possibilities of traffic which exists thereby, will ever be ousted or competed against by railway traffic—that is a very large question, perhaps too large for one to enter on here. But I would merely point out that, for a matter of that sort, it is well to turn to history, and I think it will be found that under similar circumstances elsewhere, at any rate so far as I have been able to see, wherever there has been competition between water carriage and railway carriage, under those circumstances the railway has invariably won. Well, gentlemen, I add no more; I merely wish to offer my congratulations to Colonel Rennie Taylor, to Major Davies, and to Captain Ryder for the splendid work that they have done in China, and to Captain Ryder for his most excellent paper to-night.

Mr. FRED. W. CAREY: As I have only lately returned to England from that part of China which Captain Ryder has just described so clearly to us, I am able to say that his impressions of the country through which he travelled are what one would expect from an unprejudiced observer. My own journeys in Yunnan, during the last seven years, were confined to the southern and extreme south-

western portions of that province, *i.e.* the neighbourhood of Szemao and the Chinese Shan States; and I notice that Captain Ryder has said little or nothing about the extraordinary number and variety of hill tribes one meets with in Yunnan. During my stay there this was a subject that interested me very much. In every little market, as one travels along, one sees different tribes of hill people, wearing curious costumes and speaking each their own dialect. The Chinese, with their characteristic contempt for all alien races, can give no account of these numerous tribes. They distinguish each by some more or less opprobrious nickname, and are content. I remember the indignant answer I received from one Chinese gentleman when I asked him if he could speak the Shan language. "Do you take me for a wretched barbarian?" said he, or words to that effect.

I quite agree with Captain Ryder that the question of railways in Western China is a political one; and I think those who clamour for the construction of railways in China are apt to forget that it does not form part of the British Empire, and that such undertakings cannot be peacefully carried through until the Chinese themselves are convinced of their utility and necessity. That day, I venture to predict, is not so very far distant. Good roads are sadly needed in Yunnan, but road-making under official supervision would mean heavy taxes on the inhabitants and passing traders, and of the two evils the people at present prefer bad roads. With regard to the opium cultivated in Yunnan, I should like to make a few remarks. Many people in this country still hold the opinion that Indian opium is being forced on the Chinese against their will. They even believe that the cultivation of opium is prohibited throughout the Chinese Empire—indeed, I saw a statement to this effect quite recently in a well-known paper. This is not true, for in Yunnan, at any rate, the cultivation of the poppy has been encouraged by the officials for fiscal reasons. Chinese tradition states that opium-smoking first took its rise in that province, and one account says that opium has been produced there since the year 1760. The annual output at present is not far short of 5500 tons, whilst in the neighbouring province of Sechuan it is considerably more. As Indian opium (none of which ever finds its way into Yunnan) is handicapped by an exceedingly heavy import duty, it is not too much to expect that in a few years' time the native will oust the foreign article from the Chinese market. The opium question, as far as England is concerned, will then die a natural death. The opium bowl used by the Chinese originated in Yunnan, and even now the bowls manufactured at Linan, Mengtsz, and Semao are in great demand all over the south of China. Nearly every woman in Yunnan can spin cotton, and in every village one sees the old-fashioned wooden loom at work weaving cotton cloth, with which all the poorer classes clothe themselves. Before the Panthay rebellion the province was the centre of a big silk industry. Now, however, only a very little silk is produced in Yunnan. The Yunnanese are essentially of a most peaceful disposition, and I am sure Captain Ryder will bear me witness when I say that, as a rule, Europeans are treated with friendliness and respect. The country people I always found most hospitable, but particularly so when I was unaccompanied by any Chinese soldiers, who, when acting as escort to Europeans, in their zeal are apt to be too overbearing.

Dr. Logan Jack: Having recently come from pretty nearly the same country which was traversed by Captain Ryder and his companions, I should like to say first, that it is impossible to overestimate the value of such accurate observations as have been made by these gentlemen. There is nothing to be compared with them so far in the history of the exploration of China. In the adjoining room, I would invite the attention of members of the Society and visitors to a Chinese map of that district, especially of the province of Sechuan, and it will be seen

what a very great difference there is. That map is a mere diagram showing the relations of the principal rivers to one another, and showing them accurately, in so far that each river falls in on the right or left bank of the principal river as it ought to do; but a matter of 50 or 100 miles error is nothing whatever in Chinese maps. I do not think that this map we have seen to-night can be the one to which Captain Ryder has referred as that to which people who venture in future to discuss Chinese railway projects must turn, because in this map (which may, perhaps, only be an unfinished proof) not even the author's route is laid down. But that map is, no doubt, available. It is, I suppose, in the hands of the Indian Government, and also in the hands of the Yunnan Company, and will be issued in the course of time. When it is available, we shall have made an immense advance on anything which has hitherto been in our hands. I am aware that the question of railways from India to China is a question which becomes a political one, and therefore is not open to discussion in this Society; but the question of the practicability of railway construction is an academic one on which we may form our opinions, and we may be aided in forming such opinions by the surveys of Captain Ryder and his companions, when they are in our hands. I gathered from his remarks that there is at least one practicable, though difficult route, for a railway, and I gather from other sources that the railway being constructed by the French towards Yunnan is by no means deficient in engineering difficulties, and possibly they are as great on that line as they will be on the proposed line from the Irrawadi, which may be completed some day or other. I believe, for my part, that the Chinese themselves in that district are fully aware of the value of that trade-route to them. Again and again, in the last two or three hundred years, they have attempted to get what the Scotch lairds used to call "a grip of the sea;" that is, they have attempted to secure a port at Irrawadi at the head of the navigation. It was only a very few years before the British occupation of Upper Burma that the last attempt on Bhamo was made, and the Chinese actually held the town for some time under very romantic circumstances. As to the amount of traffic along those lines, I think it has been considerably underestimated. I met, in the course of a journey from Chengtu and up by the Tibetan border, down the Yangtse and across the Mekong and Salwen to the Irrawadi, enormous trains of mules and packers, hundreds of them two or three times a day, and each mule will carry at any rate a couple of hundred pounds. Ten of them will carry a ton, and that traffic is carried on in the face of all the difficulties which are inseparable from the indescribably bad condition of Chinese roads. These roads were paved hundreds of years ago in some instances, have been washed away and never repaired, and are carried without grading, by means of flights of steps, up and down the mountain-sides. In spite of all that, Western and American produce, in the shape of cotton, tobacco, condensed milk and kerosine, find their way over long distances into the interior of Szechuan, and if these difficulties were lessened —if a railway existed—then I have no doubt the volume of the trade would be enormously increased. As to the population, Yunnan was almost depopulated during the Mohammedan rebellion, and there are traces of that depopulation on every hand. But it is patent to every traveller who passes through the country that it is being repopulated by immigration from other provinces and by the natural increase in a country where there is plenty of room to spread out. Captain Ryder has told us that among the lamas he met with a great deal of hostility. I must confess that surprised me considerably, because my experience amongst the lamas, where I was often a guest of the priests, was very much more pleasant, and I found them extremely courteous and amiable. It has just struck me as possible that the display of a foreign armed force in this expedition may have had

something to do with the hostility which Major Davies and Captain Ryder and their party met with. At all events, in my case the lamas were exceedingly kind and courteous, and nothing could exceed their hospitality. I do not wish, at this late hour, to trespass further on your time, but I am glad to have had this opportunity of thanking Captain Ryder for this most interesting paper, and I am sure we shall all especially welcome those maps when we do ultimately see them.

Mr. JOHN HALLIDAY: I did not expect to be asked to speak this evening, and I really have very little to add to the able address which Captain Ryder has given us, and which Major Davies has also given us, and Dr. Jack. I suppose I am called upon as I have something to do with the Yunnan Company, which is practically one of my babies, and it has paid all the expenses of this Expedition, and even the wear and tear of the survey instruments which were used. I would impress upon the audience that they should not take their ideas of Yunnan from those photographs. You will have observed the terraces were as precipitous as the mountains all round the valleys, showing that the photographs do not do justice to the country as a railway country. The surveys which we have from Captain Watts Jones, in which he has delineated the superficial and the horizontal outline of the country, show no very bad country whatever, except a few miles between Yunnan-fu and the Yangtse valley. It is not more difficult than the railways in the Rocky mountains. There are no impracticable engineering problems. The biggest mountain which stands in our way at present is the Chinese Government, for they have never confirmed the concession which our Government imagined they had secured. Four or five years ago, when this company was started and the survey began, the Foreign Office, the War Office, the India Office, and the Burma Railways, all combined to encourage us to make the survey. But I am afraid there is very little chance of any railway being made for many years. The trade, however, is increasing very largely, and if we could even get a cart-track—a practicable road—the increase of trade would be enormous. At present, as Dr. Jack has told us, the mules have practically to go up and down stairs—up the one side of the hills and down the other. It is a wonder they get along at all. I have only to thank Captain Ryder and Major Davies for their interesting address, and I also thank you, Mr. President, for asking me to say a few words.

Captain RYDER: There are very few points in the discussion that want answering, as everybody seems much of the same opinion. I should like to mention, with reference to what Dr. Jack has said about the map, that it was only intended absolutely and entirely as an index map to give any one who attended here an idea of what I was going to talk about. It is not a map as we would call it; it is a guide. Our maps, as we survey them, I suppose, would cover the whole of this green cloth. And about our routes being marked; if we had marked our routes—well, I travelled 4000 miles, and the other officers did much about the same—as our routes crossed and recrossed, if we had marked them, there would not have been room for anything else much on the map. Besides the maps that the Government of India are publishing of our surveys, the Geographical Society here are reducing our surveys to a fairly workable scale, and I hope they will be published soon. With regard to the remark by Mr. Halliday about the expenses of the Expedition, I think it right to say that, so far as I was concerned, my expenses, and the expenses of those under me, were entirely paid by the Government of India. So I think they should receive some credit for the results of our expeditions.

The PRESIDENT: Now, it only remains for us to express our thanks for the

interesting paper we have listened to this evening. For more than thirty years back we have had accounts of this most interesting part of China from such men as Lieut. Garnier and poor Captain Gill, and Cooper and Colquhoun, and, above all, from Mr. Baber; and I think it is a very remarkable thing that the whole of these pioneers were most distinguished geographers, and six of them were Gold Medalists of the Society, so that at intervals during that long period we have had our interest aroused in Yun-nan by very capable and very able geographers. Now at last we have received a scientific survey of the greatest value and importance, and we have certainly to thank the Yunnan Company for its liberality, and also the Indian Government. Through their means, Major Davies and Captain Ryder have executed this admirable survey. I am sure you will all wish to vote your thanks to Captain Ryder for his paper, which has given rise to such an interesting discussion, and also for the admirable way in which he has illustrated it.

EXPLORATIONS IN MEXICO.*

By CARL LUMHOLTZ.

My explorations and researches in north-western Mexico extended over a period of more than five years. On my first expedition I travelled under the auspices of the American Geographical Society of New York, and the American Museum of Natural History of New York; but later I have been in the service of the last-named institution alone. My researches have been mainly of an ethnological and archæological character; but as the country explored is very little known, and partly unknown, I may hope that what I can tell in the limited space of time allotted to me may prove of some interest to you.

Between the years 1890 and 1898 I made altogether four expeditions to Mexico. My main field was the western Sierra Madre, which may be considered as a continuation of the Rocky mountains, and stretches through the greater part of Mexico and down through Central and South America. In this way a practically uninterrupted chain of mountains is found from Behring strait to Cape Horn. The Sierra Madre del Norte offered a specially wide field for scientific researches. The northernmost part of this Sierra, from the border of the United States south about 250 miles, was until recent times under the undisputed control of the Apaches, those wild Indians whose hands were against every one, and every one's hands against them. It was only after the American General Crook, in 1883, had subdued these savage rovers that it had been at all possible to make scientific researches in those regions. But small bands of Shis Inday ("the men of the woods") were still left, and my party had to be made strong enough to meet all difficulties that might be threatened from them.

* Read at the Royal Geographical Society, December 15, 1902. Map, p. 220.

As my expedition in 1890 was the first which would enjoy the comparative safety of that district, I thought that the cause of science would be best served by taking with me a number of scientific men and collectors in various branches. Prof. W. Libbey, of the University of Princeton, N.J., with his laboratory assistant, represented physical geography. The late Mr. A. M. Stephen was our archæologist, having as assistant Mr. R. Abbott. Messrs. C. V. Hartman and Mr. C. E. Lloyd were botanists; Mr. F. Robinette, zoological collector; and Mr. H. White, the mineralogist of the expedition.

With a party of altogether twenty-six men and nearly a hundred animals, I, in the winter-time, succeeded in crossing the Sierra Madre from Naocri, in Sonora, to Casas Grandes, in Chihuahua, and there for ten months excavations were conducted at San Diego, near the famous ruins of Casas Grandes.

On my second expedition I followed the Sierra Madre southwards from my crossing-line, in the beginning through uninhabited regions, but later passing the country of the Tarahumares and the Northern Pimas. The Tarahumare Indians of the Sierra Madre live in certain parts of the country to a considerable extent in caves, and as they are anthropologically one of the least-known tribes in Mexico, I decided to study them. As this could not easily be done with an expedition that was still quite largo, I gradually discharged my followers until at last I remained alone with a few Mexicans.

The rich field for ethnological studies which Mexico offers irresistibly called me back to new researches, and I entered on my third and longest expedition, which lasted from March, 1894, to March, 1897. At the outset I kept two or three Mexicans with me, but I soon found that the so-called civilized Indians, or even primitive Indians, were my best companions; for not only did their mere presence assist me in gaining the confidence of their fellow-tribesmen, but they were themselves a constant and valuable material for study. As on my former expedition, I remained for months with different tribes, discharging my companions, and living among the Indians. I spent altogether a year and a half among the Tarahumares, and up toward a year among the Huichols. In 1898 I revisited both these tribes. Always at first the natives would resist me, and I have in more than one tribe been considered as a man-eater, subsisting on women and children, whom I killed by the camera. Besides, they attributed to me designs on their lands. They have learned to be distrustful of the white man, which nobody can wonder at when remembering how little the whites have left them of their once large countries; but I succeeded gradually in gaining their friendship and their confidence, specially by my ability to sing their songs, and by always treating them justly.

In this manner I gained a knowledge of these people which in no other way could have been obtained. When my stock of civilised

provisions gave out, after having been for five or six months without connection with the outer world, I was restricted to the food that the Indians could give me. Game is not very plentiful in Mexico, except in the extreme north, and the traveller cannot depend upon getting food by his gun. As in Australia, my favourite drink was water and honey. It is both refreshing, and gives one an appetite when having to eat monotonous dishes.

In the northernmost part of Sierra Madre del Norte, which at present is uninhabited but for some colonies of Mormons in the extreme eastern and western parts, there are few traces of habitation; they consist mainly in small terraces of stone, generally across small valleys, and which probably served agricultural purposes, as the Tarahumares, though rarely, use somewhat similar trincheras at the present time. Rude fortifications may also be seen. More important are ancient cave-dwellings, the houses being of practically the same kind as those found in similar circumstances in the south-western part of the United States. Many of these were carefully examined by my expedition. Over five hundred jars were excavated near Casas Grandes, beautifully decorated in designs that resemble somewhat those of the Pueblo Indians, but in reality are intermediary between the culture of these people and that of the valley of Mexico.

From the northern limit of the Tarahumare country to the end of the Sierra Madre del Norte antiquities are very rare indeed. A few caves with rude habitations or other signs of having been inhabited may be seen; also sometimes circles of upright stones placed solidly in the ground and protruding some 6 inches or more.

I visited altogether nine tribes, and brought back a large material to illustrate their ethnical and anthropological status, besides extensive information with regard to their customs, religion, myths, and traditions. A more or less complete linguistic material from the different tribes was secured, among which should be mentioned the now nearly extinct Tubar (a dialect of the Nahuatl language). Seventy airs and melodies were recorded mostly through graphophone. Over two hundred skeletons and skulls were procured, samples of hair, etc. A unique collection of ancient large terra-cotta figures from Iztlan, in Jalisco, should be mentioned, as well as a hitherto unknown kind of pottery from the neighbourhood of Guadalajara, a kind of encaustic ware with excellent colours. Finally may be mentioned, as results of my expeditions, a collection of about fifty-five mammals, of which one, *Sciurus Apache*, was new to science, about one thousand birds, and a large botanical collection which yielded twenty-seven new species. among them a very beautiful pine tree with whip-like branches (*Pinus Lumholtzii*).

It has been the purpose of my expeditions to throw light on the relations between the ancient cultures of the valley of Mexico and that

of the Pueblo Indians of the south-western part of the United States, to give a correct picture of the ethnical status of the Mexican natives of to-day, and incidentally at the time of the conquest, as well as to throw light on certain phases in the development of the human race. Most of what I have to tell regards a part of the republic of Mexico which never is visited by tourists, and which even for most of the Mexicans is a *terra incognita.*

The Sierra Madre del Norte is a vast mountainous country from 6000 to 8000 feet elevation, sometimes rising to 9000. Toward the north tracts of rough country may be seen, for instance, around the once famous mine Guaynopa, north-west of Temosachic, where the landscape appears as a wave of ridges and peaks, pinnacles of reddish conglomerate adding to the wildness of the landscape. Generally, however, the sierra consists of low hills and valleys, with a small llano now and then. The largest llano in the Sierra Madre del Norte is near Guachochic, in the central part of the country of the Tarahumares, being 12 miles long and 3 miles wide. Very characteristic of the landscape are the so-called barrancas, precipitous abysses which traverse the mighty mass of the sierra like huge cracks running nearly from east to west. In the country of the Tarahumare—that is to say, the state of Chihuahua—there are three very large barrancas. They are designated as Barranca de Cobre, Barranca de Batopilas, and Barranca de San Carlos. The Sierra Madre rises so gradually in the east—for instance, when entered from the direction of the city of Chihuahua—that one is surprised to be suddenly almost on top of it. The western side, however, falls off more abruptly, and presents the appearance of a towering ragged wall. In accordance with this general trait of the mountain system, the beginnings of the barrancas in the east are generally slight, but they quickly grow deeper, and before they disappear in the lowlands of Sinaloa they sometimes reach a depth of from 4000 to 5000 feet. Of course they do not continue equally narrow throughout their entire length, but open up gradually and become wider and less steep. The traveller, as he stands at the edge of such gaps, wonders whether it is possible to get across them. They can in a few places be crossed, even with animals if these are lightly loaded, but it is a task hard upon flesh and blood.

Besides these large barrancas, which impede the traveller in the highlands and necessitate a course toward the east, there are innumerable smaller ones, especially in the western part of the range, where large portions of the country are broken up into a mass of stupendous rock-walled ridges and deep chasms. A river generally flows in the barrancas between narrow banks, which occasionally disappear altogether, leaving the water to rush between abruptly ascending mountain-sides.

The sierra is covered with vast pine forests, never as yet touched

by the woodman's axe, and journeying on these highlands the traveller finds nothing to remind him that he is on the southern latitudes except an occasional glimpse of an agave between rocks and the fantastic cacti, which, although so characteristic of Mexican vegetation, are comparatively scarce in the high sierra.

Along the streamlets which may be found in the numerous small valleys, we meet with the slender ash trees, besides alders, shrubs, willows, etc. Conspicuous in the landscape at lower elevations is the madroña (*Arbutus Texana*), with its pretty strawberry-like edible berries. Flowers are scarce, but in the north the carmine-red Amaryllis may be encountered among others. It is a perfect treat to meet now and then, in the dry and sandy country, and at such a chilly elevation, this exquisitely beautiful flower, which is here appreciated only by the humming-birds. Edible plants, *Mentha*, *Chenopodium*, *Cirsium*, for instance, are at a certain time numerous.

A little further down we meet with an agave called amole, whose gigantic flower spike is well-nigh a botanical wonder. Once I decided to measure one of them. The spike, without the stalk, was 15 feet 8 inches long, and at the thickest part 31 inches in circumference. After counting the flowers on one portion, I estimated that the entire spike bore at least twenty thousand beautiful blossoms each as large as a tulip. It required two men to carry it, and as they walked along they were followed by humming-birds, which remained industriously at work in what they doubtless considered their own private garden.

Animal-life is not particularly plentiful in the sierra, still deer, bears, and mountain lions are fairly common, and there are many kinds of squirrels and rats. The jaguar (*Felis onza*) is found now and then on the summits of the barrancas. Eagles, hawks, turkeys, blackbirds, and crows are the most noticeable birds. There are many species of woodpeckers, the most remarkable of which is the greatest woodpecker in the world (*Campephilus imperialis*), which are found in pairs throughout the Sierra Madre del Norte.

The climate in the sierra, although not so pleasant, on account of the constant winds, is extremely salubrious, the heat never exceeding 97° Fahr., while the nights are deliciously cool. Lung diseases are here unknown. When I asked an old American doctor in the mining town Guadalupe y Calvo, Chihuahua, about his experience in regard to the health of the people, he said, "Well, here in the mountains they are distressingly healthy. Despite a complete defiance of every sanitary arrangement, with the graveyards, the sewers, and a tannery at the river's edge, no diseases originate here. When cholera reached the mountains some years ago, nobody died from it. The people simply took a bath in Mexican fashion, and recovered." Down in the barrancas, however, where the heat often becomes excessive, the climate is far from healthy, and I have seen even Indians ill with fever and ague,

contracted during the rainy season. The western coast of Mexico, especially from Tepic southward, is very unhealthy, and during my stay there several Mexicans died from pernicious malaria.

Between these two extremes, on the slopes of the sierra toward the warm country, at an elevation of 5000 feet, I found the most delightful climate I ever knew. It was like eternal spring, the air pure, and the temperature remarkably even. There is a story of a Mexican woman who, settling in that part of the country, broke her thermometer because the mercury never moved, and she therefore concluded that it was out of order.

The tribes I visited were, counting from the north, the Northern Pimas, the Tarahumares, the Tubars (a now nearly extinct people, who spoke a dialect of Nahuatl), the Tepehuanes, the Coras, the Huichols, the Tepecanos, the Nahuas of the west coast of Mexico, and the Tarascos of Michoacan. These Indians are very much of similar physique, medium sized, strong, and healthy, the colour of the body of a light chocolate-brown colour, and the hair jet black and straight. They have the same kind of food, raising maize and beans, which is their main source of subsistence. The advent of whites has, to a certain extent, modified their life through the introduction of cattle and sheep. The cattle is never killed expressly for eating purposes, but is used as sacrifice at the rain-making feasts, and after an insignificant part has been given to the gods, the rest is partaken of by the people. The cattle is considered just as valuable as the deer, the turkey, and other animals that are used as sacrifice to the gods. From the hide sandals are made. The wool is manufactured by the women into blankets and girdles of ever-varying patterns. The clothing is generally made from cheap cotton cloth bought from the Mexicans. The plough and the ox have largely taken the place of the primitive agriculture, though the ancient mode of cultivating the fields may yet be found in vogue in certain tribes—the cutting down of the brushwood, which later is burnt, and the planting of the corn in holes made by a stick in the ground, the holes being covered up with earth by the help of the foot. Bows and arrows are still the arms of most of these tribes. None of the Mexican tribes, to my knowledge, chastise their children, who grow up to be very independent, and have not much affection for their parents. The Tarahumare boy may even strike his father or mother. The mothers, however, are very fond of their children, who in early years are very charming, and never too much forward.

To the casual observer the native appears dull and heavy, so much so that at first it would seem hopeless to get any intelligent information out of him; but on better acquaintance it will be found that the faces of Mexican Indians have more variety of feature and expression than those of the whites. At the same time, it is true that the individual does not show his emotion very perceptibly in his face. One has to

look into his eyes for an expression of what passes in his mind, as his face is not mobile; nor does he betray his feelings by involuntary actions. If he blushes, as he sometimes does, the colour extends down the neck, and is visible in spite of his dusky skin. Laughter is never immoderate enough to bring tears to the eyes. Like the Mexicans, the Indians beckon with their hands by making downward movements with their fingers. The principal trait of their character is distrust, but they are intelligent, have keen senses, and if treated well will comply with agreements made with them. The principal faults of these Indians are that they have a propensity to appropriate things that strike their fancy, though they never stole anything from me. The Tarahumare, however, does not cheat in bargains until he is taught so by the Mexicans. These tribes, besides, do not tell the truth unless it suits them to do so.

They all speak of the sun as "father," and the moon as "mother," and the pivot round which their religion moves is rain, or, rather, how to prevail upon the gods so as to make them liberate the clouds, which they want to keep for themselves. The gods are supposed to be angry with man and jealous, but the way to appease their wrath is dancing, sacrificing, singing, and innumerable ceremonies. Rain is what these people first of all pray for, next long life and luck. As regards the Huichols this may seem strange, because they have in their country a regular, though not particularly heavy wet season. But owing to the steepness of their primitive fields, most of the falling rain runs off without penetrating the soil, therefore almost incessant rain is needed to make the crops grow. If it stops raining for several days, the young maize plants begin to be scorched by the heat of the sun. The Mexican Indians certainly recognize the immortality of the soul, but they are afraid of the dead, whom they consider anxious to have their relatives follow them into the other life. The dead, therefore, are thought to be endeavouring to make the survivors ill to keep them company, besides being jealous of the things they left behind. These Indians, therefore, make several feasts in the course of a year after the death of a person in order to drive him away for good.

Though, to use the expression of the late distinguished American ethnologist, Mr. Cushing, "all Indians are tarred with the same stick," there is considerable difference to be found in the various tribes, both in regard to physical and mental habits, habitations, customs and habits, and beliefs, not to mention the diversity of language. While nothing, for instance, will disturb the equanimity of the Tarahumares, the Tarascos of Michoacan are of quite a choleric temperament. I have seen babies getting into a furious rage against their mothers, who on their side become equally excited; but after a few minutes the whole thing is over. This same quick temper may be one reason of the curious frequency of jaundice in a certain part of the Tarasco country.

The Tarahumares have a great number of games and pastimes all the year round; among the Huichols not one is found. Many more dissimilarities in the tribes studied by me might be mentioned.

The two tribes of this mountainous region that are of special interest, because least affected by civilisation, are the Tarahumares and the Huichols. The Tarahumares live in wooden structures, but, in their land of weather-worn porphyry and inter-stratified sandstone, natural caves are met with everywhere, in which the people find a convenient and safe shelter. Although it may be said that houses are their main habitations, still the Tarahumares live in caves to such an extent that they may be fitly called the American cave-dwellers of the present age.

These cave-dwellers are in a transitory state, most of them having adopted houses and sheds; but many of them are still unable to perceive why they should give up their safe and comfortable natural shelters for rickety abodes of their own making. Some of them live permanently in caves, but most of them only temporarily so.

In front of the entrance to the cave there is generally a wall of stone, or of stone and mud, raised to the height of a man's chest, as a protection against wind and weather, wild beasts, etc. The cave is fitted up just like the houses, with grinding-stone, earthen jars and bowls, baskets, gourds, etc. The fire is always in the middle, without hearth or chimney, and the jars in which the food is cooked rest on three stones. A portion of the ground is levelled and made smooth for the family to sleep on. As often as not there are skins spread out on the floor. Sometimes the floor space is extended by an artificial terrace in front of the cave. In a few cases the floor is plastered with adobe, and I have seen one cave in which the sides too were dressed in the same way. Generally there are one or two storehouses in the caves, and these constitute the chief improvement.

These cave-dwellers are not related to the ancient cliff-dwellers in the south-western part of the United States and Northern Mexico. Their very aversion to living more than one family in a cave, and their lack of sociability, mark a strong contrast with the ancient cliff-dwellers, who were by nature gregarious. Although the Tarahumare is very intelligent, he is backward in the arts and industries. Tarahumare pottery is exceedingly crude as compared with the work found in the old cliff-dwellings, and its decoration is infantile as contrasted with the cliff-dwellers' work. Moreover, he is utterly devoid of the architectural gift which resulted in the remarkable rock structures of the early cliff-dwellers. These people, as far as concerns their cave-dwelling habits, cannot be ranked above troglodytes.

The endurance of the Tarahumare is truly phenomenal. A strong young man carried a burden of over 100 lbs. from Carichic to Batopilas, a distance of about 110 miles, in seventy hours. While

carrying such burdens they eat nothing but pinole (corn toasted and ground), a little at frequent intervals. With their dogs they pursue deer for days through rain or snow, until they finally corner it and shoot it. By the Mexicans these people are sometimes employed to run wild horses into the corral. The Indians rest a little at night, but they keep their horses on a pretty constant move, until they at last are brought into the corral, the Indians not showing any fatigue, but the horses thoroughly exhausted. They love to feel warm, and they may often be seen lying on their stomachs in the sun. On the other hand, they also endure cold unflinchingly. On a cold winter morning, when there are a few inches of snow on the ground, many a Tarahumare may be seen with nothing on but his blanket fastened around his waist, pursuing rabbits.

They certainly do not feel pain in the same degree as we do. On this point any collector of hair can easily satisfy himself. So much importance being attached to the structure of the hair, I made a collection from different individuals. They were willing enough to let me have all the samples I wanted, for a material consideration, of course; but the indifferent manner in which they pulled the hair from their heads, just as we should tear out hairs from the tail of a horse, convinced me that inferior races feel pain to a less extent than civilised man. I once pulled six hairs at a time from the head of a sleeping child without disturbing it at all; I asked for more, and when twenty-three hairs were pulled out in one stroke, the child scratched its head a little and slept on.

Though quite ingenious in devising many kinds of traps for birds and animals, the Tarahumares hunt squirrels in the most primitive way --by cutting down the tree on which an animal is discovered. Sometimes it will escape when the tree falls, and then the man has to cut down another tree, and thus he may go on felling as many as ten trees before he can bag his game—not a very substantial reward for a whole day's work.

Fish are killed by a small spear shot from a diminutive bow, but a more profitable way of catching fish is by poisoning the water by two species of agave.

Among the intoxicating drinks of these people should be mentioned the native beer, called in Mexican Spanish "tesvino;" it is produced from maize, looks like milky water, and has quite an agreeable taste, reminding one of kumyss. To make it, the moist corn is allowed to sprout; then it is boiled and ground, and the seed of a grass resembling wheat is added as a ferment. The liquor is poured into large earthenware jars made solely for the purpose, and it should now stand for at least twenty-four hours; but inasmuch as the jars are only poorly made, they are not able to hold it very long, and the people take this responsibility on themselves. A row of beer-jars turned upside down in front of a

house is a characteristic sight in the Tarahumare region. It should be noted, however, about this intoxicant, as well as about all other Indian beverages, that they are not indulged in as a pastime, but are part of their religion, and are thus only enjoyed for a certain purpose—to gain good crops, health, life, etc. In the same way, in ancient times, the well-known drink "pulque," among the Aztecs, was restricted by law to their religious observances.

For a barbarian, the Tarahumare is a very polite personage. In his language he even has a word, "rĕkó," which is the equivalent of the English "please," and which he uses constantly. In spite of this, he is not hospitable; the guest gets food, but there is no room for him in the house of a Tarahumare. A visitor never thinks of entering a house without first giving the family ample time to receive him, and good manners require him to stop some fifteen or twenty yards off. In order not to embarrass his friends, he does not even look at the house, but remains sitting there gazing into vacancy, his back or side turned toward the homestead. Should the host be absent, the visitor may sit there a couple of hours or so; then he will rise and go slowly away again.

Husband and wife never show their affection in public, except when drunk. Parents kiss their little ones on the mouth and on the stomach, and the youngsters express their love for each other in the same way. This tribe is the only one where I found love-songs, but the custom of the country requires the girl to do all the courting. She is just as bashful as the young swain whom she wishes to fascinate, but she has to take the initiative in love-affairs. The young people meet only at the feasts, and, after she has gotten mildly under the influence of the native beer that is liberally consumed by all, she tries to attract his attention by dancing before him in a clumsy way up and down the same spot. But so bashful is she that she persistently keeps her back turned toward him. She may also sit down near him and pull his blanket, and sing to him in a gentle low voice a simple love-song. When she desires to bring matters to a focus, she begins to throw small pebbles at the chosen one. If he does not return them, she understands that he does not care for her, and the affair ends then and there. But if he throws them back at her, they are at once betrothed.

The Tarahumare woman bears her child alone, and next day she works as usual as if nothing had been the matter with her. On the fourth day the mother goes down to the river to bathe, leaving the little one exposed in the sun at least an hour, that Father Sun may see and know his child; the baby is not washed until it is a year old.

Among the many games and sports of the Tarahumares should be mentioned foot-races. No doubt these people are the greatest runners in

the world, not in regard to speed, but endurance. A Tarahumare will easily run 170 miles without stopping. The propensity for running is so great that the name of the tribe alludes to it. Tarahumare is a Spanish corruption of *ralámari*, the meaning of which, though somewhat obscure, may doubtless best be given as "foot-runners," because *rālá* certainly means "foot." The race is always between two localities. A peculiar feature is that the men toss along a small ball as they run, each party having one of their own. These balls are about 2½ inches in diameter, and carved from the root of the oak. The foremost runner kicks it with the toes of his right foot, so as to make it bound along as far as 100 yards, and he and all the men behind him follow in the same trot as before. On the day of the race the forenoon is spent in making bets, the managers acting as stakeholders. These people, poor as they are, wager their bows and arrows, girdles, head-bands, clothes, blankets, beads, balls of yarn, corn, and even sheep, goats, and cattle. The stakes of whatever nature are tied together—a blanket against so many balls of yarn, a girdle against so many arrows, etc. They run steadily hour after hour, mile after mile, and good runners make 40 miles in six or eight hours. The public follows the race with great enthusiasm, the interest growing with each circuit. The wives of the contestants throw tepid water over the shoulders of the runners, by way of refreshing them. As darkness comes on, torches of resinous pine wood are lighted and carried along to illuminate the path for the runners that they may not stumble, making the scene one of extreme picturesqueness as these torch-bearers, demon-like, hurry through the forest.

The Huichols, who are living in the southern part of the Sierra Madre del Norte, in the state of Jalisco, are to the ethnologist a most remarkable tribe. They number about 4000 souls, and their country is only about 40 miles long and 20 to 25 miles broad, and, being exceedingly mountainous and difficult of access, it has left the people in a very primitive condition. They were only conquered by the Spaniards in 1723, and the missionaries who followed in the wake of the victorious troops established four churches. To-day their churches are in ruins, and no priests are living among them; the impress made on their religion was exceedingly slight, and probably they are the most primitive tribe in Mexico, practically living in the same conditions as when Cortez first put foot on Mexican soil.

It would carry me too far to relate all the difficulties I had in entering the Huichol country, which I approached from the west. Obstacles arising from the prejudice and fear of the natives threatened to prevent me from arriving at the Pueblo of San Andres, my immediate goal. However, I successfully made my way, and though some of the Indians ran away into the forest at the unusual sight of my expedition, most of them received me in stolid silence, evidently accepting my baneful

presence as something they were powerless to avert. Quite a number of Indians had come to the village to attend a rain-making feast. My arrival did not prevent the feast from coming off, as the Indians never postpone a ceremony. Torrents of rain were already falling before the performers started their ceremonies, but this in no wise abated their fervour in singing, their object now being to prevent the rain from stopping. My wishes were just as eager to the contrary, as the rickety shed which had been assigned to me, though the best available, was by no means waterproof. It is trying, in any case, to have to make one's self at home against the wishes of one's host, and the inclemency of the weather much intensified the discomforts of the situation. I became reconciled to my fate, however, by the really beautiful singing of the leader. As a matter of fact, I have never, in any primitive tribe, heard such good singing as among the Huichols. The steady downpour of rain, punctuated by fitful flashes of lightning, formed a wierd and fantastic accompaniment to the sympathetic singing, which came to me through the pitchy darkness of the night like a voice from fairyland. It sounded different from anything I had ever heard among Mexican Indians or elsewhere, and it was as novel as it was enchanting.

The name *Huicholes* is a Spanish corruption of Víshálika, the word signifying "healers," a name they fully deserve, as about one quarter of the men are medicine men, or shamans. These Indians are related to the Nahua people, and while the Aztec Empire came to a tragic end nearly four hundred years ago, the humble Huichols have maintained themselves to the present day in their mountain fastnesses, and, like a fossil among nations, form a most interesting subject for study. They are very bright, and have better memories than the Mexicans, but their morals are somewhat affected by their cunning. They are quicker to invent a lie than any Indians I have met. A Huichol knows how to look out for himself, but is kind-hearted and hospitable. They have no personal courage, and prefer assassination of a stranger to meeting him in open fight. At the feasts, when intoxicated, the men may get into quarrels. Like the fighters of Homeric days, they first abuse each other violently with words. But unlike his forerunner of old, the Huichol, when entering a bout, very sensibly hands his weapon to his wife.

Taking it all in all, their great gift of music, combined with their ready response to emotional influences, the immense wealth and depth of their religious thought, and their ingenuity in expressing it pictorially cannot help but fascinate the observer. They are more religious than any people I have met, practically their whole life being one of devotion to their gods. There are eighteen temples in the country, which, like their houses, are round, made of stone, and covered with thatched conical roofs. There is, besides, a great number of sacred caves and

god-houses, filled with an immense number of ceremonial objects of various kinds, through which they express their prayers to their gods.

Space does not allow me to enter into any details regarding their religious system with its extensive symbolism that throws light on the ceremonial objects and religious conception of the ancient Aztecs.

I must, however, before closing, in a few words touch upon a peculiar plant-worship which the Huicholes have in common with the Tarahumares, namely, the cult of certain species of small cacti. Among the Tarahumares there are several varieties of cacti worshipped and feared, species of *Mammilaria* and *Echinocactus*.

Among the Huichols there is only one or two varieties of cacti worshipped, namely, *Lophophora Williamsii* and *Lophophora Williamsii*, var. *Lewinii*. In the United States they are called mescal buttons, and in Mexico *peyote*. Strange to say, although the Huichol Indians live many hundred miles south of the Tarahumares, with whom they are neither related nor connected in any way, they apply the same name, hikuli, to these mescal buttons, which are found on the central plateau of Mexico. This plant is supposed to talk and sing, and to feel joy and pain. When taken it exhilarates the human system, and allays all feeling of hunger and thirst; it also produces colour-visions. When fresh it has a nauseating, slightly sour taste, but it is wonderfully refreshing when one has been exposed to great fatigue. Not only does it do away with all exhaustion, but one feels actually pushed on, as I can testify from personal experience. In this respect it resembles the Peruvian coca; but, unlike the latter, it leaves a certain depression, as well as a headache. Although an Indian feels as if drunk after eating a quantity of hikuli, and the trees dance before his eyes, he maintains the balance of his body even better than under normal conditions, and he will walk along the edge of precipices without becoming dizzy. Another marked effect of the plant is to take away temporarily all sexual desire. This fact, no doubt, is the reason why the Indians, by a curious aboriginal mode of reasoning, impose abstinence from sexual intercourse as a necessary part of the hikuli cult.

The plant has distinct medicinal properties, and is applied externally to cure snake-bites, burns, rheumatism, etc. With the Indians, however, it is mainly an object of worship, and a regular cult is instituted whose main purpose is to promote the health of the tribe as well as to bring rain. The Huichols undertake, in October, pilgrimages to a locality situated near San Luis Potosi, consuming forty-three days going and coming. On the return of the hikuli-seekers to their own country, they at once begin preparations for the hikuli-feast. An important condition for the feast is to secure a certain number of deer, and to have cleared the fields for the cultivation of corn for the ensuing year. The pilgrimage and preparations for the feast may consume altogether four

months, during which they are pledged to abstinence, do not partake of salt, and do not wash except with water brought from the country of the hikuli. The plant is often eaten fresh, slices being cut off much as we would eat an apple; but at a feast a kind of liquor is made by grinding the plants and mixing them with water. The main feature of the feast is a peculiar kind of dancing by men and women, whose faces are painted with various designs with a symbolic meaning.

As regards the fate of the tribes of the Sierra Madre del Norte, it can ultimately be but one—their absorption into the great nation to which they belong. The vast forests and mineral wealth of those regions cannot always remain the property of my dusky friends; the weaker must succumb to the stronger, and the Indians will ultimately all become Mexicans. True, the state of development which the tribes of the Sierra Madre did attain is not beyond the pale of primitive barbarism, owing to their environment and conditions of life; but the country has no reason to regret the inoculation of aboriginal strength and thought.

The Indian of Mexico is treated well by those in power, and he is considered a citizen. The influence upon the Mexican nation of the tribes that had risen to a certain stage of civilisation at the time of the conquest has been great and beneficial. Pure-bred Indians have become prominent as governors, generals, and clergymen. Honest, lion-hearted Benito Juarez, who guided the republic through its most severe crisis, was a pure-bred Zapotec Indian; and I hardly need to remind you that the present head of the Mexican Republic, President Porfirio Diaz, who has a certain amount of Mixtec blood in his veins, is not only a great man in his country, but one of the great men of our time.

Before the reading of the paper, the President said: There was no Council meeting this afternoon, and the candidates, of whom there are a large number, will be elected at the next meeting of the Council. We have with us this evening a very experienced Norwegian traveller, Dr. Lumholtz, who has been several years in Australia, and since that he has been studying the wild tribes in the northern parts of the Sierra Madre, in Mexico. He is going to give us this evening what I am sure you will find a very interesting paper. I now call upon Dr. Lumholtz.

After the reading of the paper:—

Dr. A. C. Haddon: Dr. Carl Lumholtz has added a new chapter to the history of man. The native tribes in these parts of Mexico were hitherto unknown to anthropologists, and it is very fortunate that they had such an able and sympathetic observer as Dr. Lumholtz. Dr. Lumholtz started life as a zoologist, and, like many other zoologists who travel, he found that the highest animal, or that animal which considers itself the highest, was perhaps quite as worthy of study as are birds, reptiles, and fish; thus he was gradually won from beasts to man, and I think the change has been a good one. Unfortunately, I have not been to Mexico, but this time last year I was in New York City, and I studied the very extensive collections that Dr. Lumholtz brought over with him; and it seems as if Dr. Lumholtz has imbibed something of those great ideas which are so

characteristic of the other continent, as he has brought home an immense mass of material. He not only collected widely, but wisely; and his collections were not the mere ransacking of the people, which is so often the case with those who call themselves anthropologists, but they consist of human documents which teach a very great deal. I heard a criticism in America to the effect that he describes his results in too great detail. But I take it that students of anthropology in five hundred or a thousand years' time will not regret the detail of travellers. They will often wonder how it was we said so little about what we had seen in foreign parts. The great danger is for us to write too little, and not too much, upon what we have seen, because the rapidity with which all anthropological data are disappearing is simply appalling, and the students of man in the future will be only too thankful for every scrap of information that we at the present time can give them; and if we do not give it with the amplitude that Dr. Lumholtz has done they will deservedly blame us. What Dr. Lumholtz says about the religious feeling of these people may strike you perhaps as being somewhat strange, but it is perfectly true; and if he had only amplified that point he could easily have proved his statements. The whole life of the people is one of worship, and it is extremely interesting to see how the different characteristics of a country react on the psychological life of people; this is also marked in the social and religious life of the Pueblo Indians. Dr. Lumholtz has studied particularly the symbolism of these Indians, and in his publication one sees that every little detail and ornament has its meaning. With us decoration and ornament are usually meaningless. We live in an æsthetic world which may please our artistic sense, but which has for us very little significance; whereas you will find amongst primitive people what we consider as mere ornament and only pleasing to the eye, has to them a definite and distinct meaning. Civilization loses much of what is a great element in the life of savage people. Very few of us can realize the amount of sentiment and of religious suggestion that is conveyed by what we regard as mere ornament. Not only has this ornamentation a religious significance, not only does it recall ideas to them, but the ornaments themselves are actually prayers; so, as Dr. Lumholtz says, speaking of the embroidery on their shirts, the people themselves are clothed with prayer —every object is practically a prayer. Miss Alice Fletcher, who has lived many years among some of the American Indian tribes, has also found that there is amongst them a religion which was totally unknown to the ordinary white man. It is only when you can get their confidence—and you can only get it by sympathy —that you find that the savage scalp-hunting Red Indian has a religion which is, from a religious point of view, an extremely high and philosophical one. It is only when we get sympathetic observers like Dr. Lumholtz that we can form any conception of the inner life and feelings and aspirations of these different races. The savage has never had a fair chance till the present day. We regard him as having no culture, and because he has no culture we think he has no moral or religious ideas, and the reason why we think so is because we do not know. If we studied them as carefully as Dr. Lumholtz has done, we should find that there was precious little difference between most savage people and ourselves, with the exception, perhaps, that the savage people would be found to be more honest and more religious, and to act up to their religious convictions more than we do. I am sure every one of us has thoroughly enjoyed this lecture of Dr. Lumholtz's, and not the least valuable part, perhaps, of the lecture was those charming songs that he gave us. I have heard the songs of Australians, of Papuans, and of various tribes in Borneo and elsewhere, but I must say I never heard such musical songs as those given by Dr. Lumholtz. I only hope that this will not be the last occasion upon which we shall have the pleasure of listening to and welcoming him.

Dr. GADOW: I regret not being able to make any remarks on Dr. Lumholtz's interesting paper, for a very good reason, namely, that those parts of Mexico I have recently visited are not the same as those visited by him. But when he spoke about these people and showed us these wonderful photographs, I was struck with the fact that the tribes I have seen about the Isthmus of Mexico did not bear the slightest resemblance to those people whose photographs we have seen on the screen. He made the remark that they suffered from two faults—they did not speak the truth, and they steal. Well, to my surprise I found that during several months of sojourn at different places on both the Pacific and Atlantic sides, we never lost any article, and when I asked some of the men occasionally, how it was they could leave their things about and they didn't get taken, they said, "No, it is not the custom here." I am sorry I cannot make any further remarks.

The PRESIDENT: You will agree with me that we have listened to a paper of very great value, as well as of great interest. I call to mind that this country of the Sierra Madre was the scene of some of the most adventurous exploits and discoveries of the early Spaniards, and there can be nothing more important in ethnology than to be able to compare the manners, the customs, and arts of the isolated Indians of the present day with anything that may have been said of them when the country was first discovered. I call to mind the name of the first man who ever visited the Sierra Madre country from Europe, Cabeza de Vaca. It is a strange name. It is curious that any one should be called "head of a cow," and I am tempted to mention the reason that his ancestor got that name. It was at the time that the Mohammedans were making their last great effort to gain supremacy in Spain, and when the kings of Castille, Navarre, and Aragon united to fight them and drive them back. The Almohade sultan had formed a great camp behind the mountains of Tolosa, and when the Spanish army advanced, all the narrow passes were found to be full of Mohammedan warriors. Then a shepherd boy, named Alhaja, came to the kings and said, "I can show you a way across the mountains which is not guarded by Mohammedans, where I feed my sheep." The kings commanded that he should lead the van under the Lord of Biscay into this pasture, and it was agreed that he should place the head of a cow, which had lately been killed and eaten by the wolves, in the opening of the *barranca* or ravine leading to the pastures which opened on to the plain on which the Mohammedans were encamped, to guide the rest of the army. So they marched up, and a great battle was fought, called the battle of Las Navas de Tolosa, which in 1212 A.D. settled the question for ever whether the Christians or Mohammedans were to be predominant. And afterwards King Alphonso sent for the shepherd boy and knighted him, telling him that his name was no longer to be Alhaja, but that it was henceforward to be Cabeza de Vaca, "the head of the cow," in memory of the sign he had placed at the entrance to the ravine. And the explorer, the discoverer of this part of the world, on his mother's side, was descended from the shepherd boy. When Narvaez went to conquer Florida, Cabeza de Vaca was with him. They abandoned their ships and followed along the coast. Nearly all perished, there being no one but Cabeza de Vaca, three other Spaniards, and one negro left. They pressed on with that extraordinary intrepidity which the Spaniards of those days displayed. Cabeza de Vaca advanced from one tribe to another, slowly, but resolutely, determined to go on until he reached the other sea. He was eight years amongst these Indians who have been described to you this evening by Dr. Lumholtz, and after eight years, by the same means as Dr. Lumholtz has used, conciliatory means, he ended by becoming the friend of the Indians, and making them think he was a *shaman*, or great medicine man, and he succeeded almost alone in passing through and across these mountains down on to the

Pacific side, and at last reached a settlement of the Spaniards. He reported his discoveries at Mexico, and another expedition was sent under a Franciscan, and then another under Coronado, the governor of New Galicia, and they penetrated not only into this country which has been described to you, but further on until they reached the country of the Zuñis. Well, we have these three narratives: we have the narrative of Cabeza de Vaca, I think, if I remember rightly, written by himself; we have the narrative of the Franciscan Niza; and we have the narrative of Coronado, most ably written by another hand, and giving an account of the Indians. We have these three narratives, and it would be, of course, of the greatest interest to compare all they say about the Indians of this country with the discoveries respecting those isolated tribes which have been recently made after a study of several years by our friend Dr. Lumholtz. If he will allow me to say so, I should be inclined in some respects to compare him with Cabeza de Vaca; he has shown the same resolute determination in the face of considerable difficulties from the Indians, and in the face of considerable physical difficulties he has shown that determination to do what he intended to do which was shown by Cabeza de Vaca. He has also shown the same anxiety to make friends, and the same power of conciliating the people among whom he was, which enabled Cabeza de Vaca to cross the continent, and which enabled Dr. Lumholtz to make these most remarkable and valuable researches among the Indians. We have to thank him to-night for opening up to us a subject of the greatest interest, which I am sure was quite new to most of those present; we have to thank him for the admirable way in which he illustrated his paper; and we have to thank him for those beautiful songs, showing what powers these people have as musicians as well as in other arts which they practise. I am sure, therefore, you will all join with me in a very cordial vote of thanks to Dr. Lumholtz for his most valuable paper.

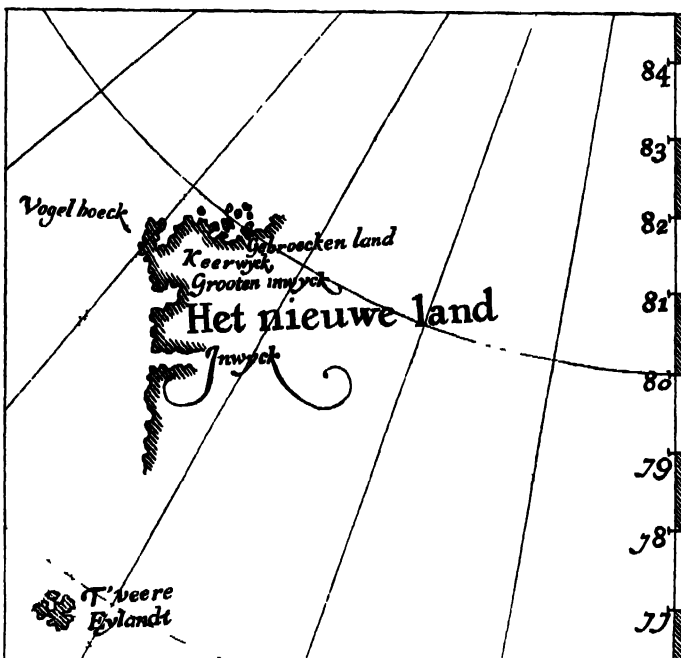
HOW SPITSBERGEN WAS DISCOVERED.

By Sir MARTIN CONWAY.

On May 18, 1596, two Dutch ships sailed from Vlieland, near Amsterdam, on a voyage destined to be famous in the annals of adventure and discovery.* In one ship Willem Barendszoon was chief pilot; the captain was Jacob Heemskerke Hendickszoon, proudly described on his monument as "the man who ever steered his way through ice and iron." In the other, Jan Corneliszoon Rijp of Enkhuizen was captain and supercargo, Arend Martenszoon of Amsterdam pilot. The chief honour of the voyage has always been given to Barendsz, but Heemskerke should not be forgotten, for he was a great sailor. He commanded the Dutch fleet at the victorious battle of Gibraltar in 1607, where he met his

* The authorities for this voyage are an extract from Barendsz's own log, printed in Hessel Gerritz' 'Histoire du pays nommé Spitsberg,' translated in the Hakluyt Society's 'Three Voyages of W. Barents' (1876), p. xvii; and De Veer's Journal of the voyage, translated in the same book, p. 70. See also De Jonge's 'Opkomst,' etc., vol. i. pp. 23–26; and S Müller's 'Geschiedenis der Noordsche Compagnie,' p. 43, note. The course of the ships is marked on Barendsz's own chart, which was engraved in 1598.

death. His monument stands by one of the central pillars of the Oude Kerk in Amsterdam. On June 9 the two ships made Bear island, and the following day eight men landed from each ship, Barendsz and Rijp being of the number. Next day, again "going on land, wee found great store of sea-mewes egges upon the shoare, and in that island wee were in great danger of our lives: for that going up a great hill of snowe, when wee should come down againe, we thought we should all have broken our neckes, it was so steep; but wee sate upon the snowe (*ons naers*) and slidde downe, which was very dangerous for us to breake



SPITSBERGEN, FROM BARENTSZ' CHART.

both our armes and legges, for that at the foote of the hill there was many rockes, which wee were likely to have fallen upon, yet by Gods help wee got safely down againe. Meane time William Barendsz sate in the boate, and sawe us slide downe, and was in greater feare than wee to behold us in that danger. . . .

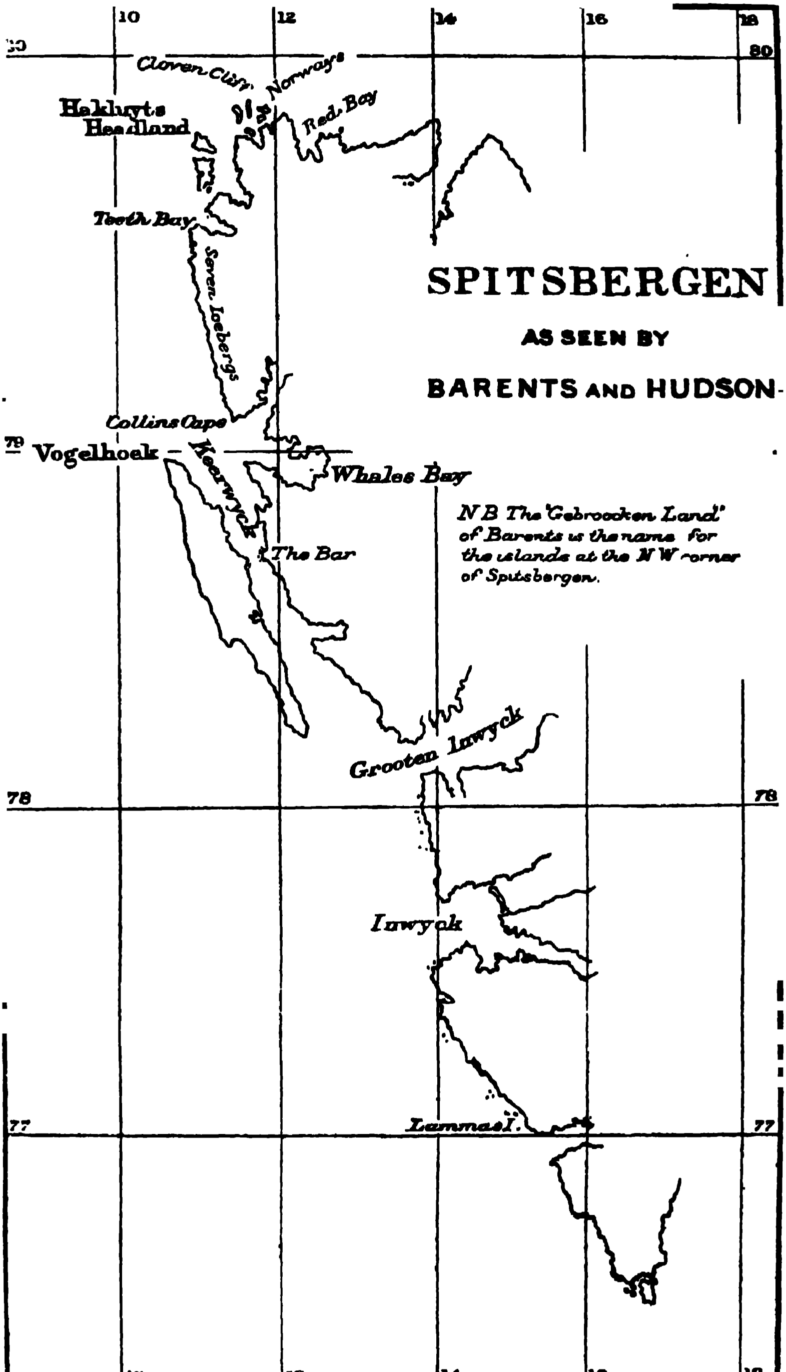
"The 12th of June in the morning, wee saw a white beare, which wee rowed after with our boate, thinking to cast a roape about her necke; but when we were neare her, shee was so great that wee durst not doe it, but rowed backe again to our shippe to fetch more men and

our armes, and so made to her againe with muskets, hargubushes, halbertes, and hatchets, John Cornellysons men comming also with their boate to helpe us. And so being well furnished of men and weapons, wee rowed with both our boates unto the beare, and fought with her while foure glasses were runne out (two hours), for our weapons could doe her little hurt; and amongst the rest of the blowes that we gave her, one of our men stroke her into the backe with an axe, which stucke fast in her backe, and yet she swomme away with it; but wee rowed after her, and at last wee cut her head in sunder with an axe, wherewith she dyed; and then we brought her into John Cornelysons shippe, where wee fleaed her, and found her skinne to be twelve foote long: which done, wee eate some of her flesh; but wee brookt it not well. This island wee called the 'Beare Island.'"

They sailed from Bear island on the 13th, in a northerly direction. At noon on the 14th they fancied they could see land to the north, but were not certain. At noon next day they were in lat. 78° 15′ N.—that is to say, off the mouth of Ice fjord, but probably some way out to sea. On the 16th they met the ice-pack north of Spitsbergen, and sailed along it eastwards for 44 miles (north-east and south-east). At noon on June 17th they were in lat. 80° 10′; steering south-south-west, they came in sight of land, which was visible for about 32 to 36 miles, trending almost from west to east. "It was high land, and entirely covered with snow." Undoubtedly the north coast of Spitsbergen between Hakluyts headland and the mouth of Liefde bay was what they saw, and this was the memorable day of the island's discovery, though De Veer makes the 19th the date of this event. On the 18th they were in lat. 80° N. They sailed through ice westwards along the land till noon on the 20th. On the 19th they were in lat. 79° 49′ according to De Veer. At noon on the 20th the western point of the land lay south-south-west, 20 miles distant. They sailed towards it, and "came close to a large bay (Red bay) which extended into the land towards the south." They made another attempt to get away to the north-west, but were driven back by the ice, and so, late on the 21st, both ships came to anchor at the mouth of Fair haven. "At the east point of the mouth," says Barendsz, "was a rock, which was, moreover, split, a very good landmark;" he obviously refers to Cloven cliff. "There was also a small island or rock, about 1⅓ (? miles) from that eastern one. On the west point also was a rock, very near." It would, therefore, appear that he anchored between Cloven cliff and Vogelsang. Here or hereabouts, in lat. 79° 50′, Barendsz set up a post with the arms of the Dutch upon it. The post remained standing till 1612, when the English carried it away.*

Next day they "took in ballast of 7 boatsful of stones, thus much

* The fact is mentioned in a resolution of the States-General, April 16, 1615.


SPITSBERGEN
AS SEEN BY
BARENTS AND HUDSON
Cloven Cliff
Norways
Hakluyts Headland
Red Bay
Teeth Bay
Seven Icebergs
Collins Cape
79
Vogelhoek
Keerwyck
Whales Bay
The Bar
N B The 'Gebroocken Land' of Barents is the name for the islands at the N W corner of Spitsbergen.
Grooten Inwyck
78
Inwyck
Lammas I.
77
10
12
14
16
18
80

because our ship was little ballasted." A great fight with a bear followed, and then they explored Fair haven with a boat, and found the Norway islands and several good anchorages. On one island where they landed, they "found many red geese-egges, which we saw sitting upon their nests, and drave them from them, and they flying away cryed, 'red, red, red;' and as they sate we killed one goose dead with a stone, which we drest and eate, and at least 60 egges, that we tooke with us aboard the shippe. . . . These were *Rotgansen* (Bernacle geese), such as come into Holland about Weiringen (near the Texel), and every yeere are there taken in abundance, but till this time it was never knowne where they hatched their egges; so that some men have taken upon them to write that they grow upon trees in Scotland that hang over the water, and such egges as fall from them downe into the water become yong geese and swimme away; but those that fall upon the land burst in sunder and come to nothing: but this is now found to be contrary, and it is not to be wondered at that no man could tell where they breed their egges, for no man that ever we knew had ever beene under 80°."

Next day, the 23rd, the weather being very clear, they went out of the bay and rounded Hakluyts headland "to seek how far the coast could extend itself." They "could not perceive the end of the land, which extended itself S. ½ E., 28 miles, as far as a high and mountainous cape [? Knottie point], which looked as if it were an island." They returned and cast anchor in the same place, and at midnight found by observation that they were in lat. 79° 42', which is the latitude of Danes island.*

On the 24th they sailed southward down the west coast or wall of the island, as De Veer calls it. "The land," says Barendsz, "was for the greatest part broken, rather high, and consisted only of mountains and pointed hills, for which reason we gave it the name of 'Spitsbergen.'" † Captain Rijp, giving evidence before the magistrates of Delft, said, "We gave to that land the name of Spitsbergen, for the great and high points that were on it." They did not, however, conceive it to be an island, but only part of Greenland, as De Veer expressly states.

On the 25th they entered and cast anchor in a bay, which must have been Magdalena bay, for it was 40 miles north of Vogelhoek. They rowed up the bay, on the south side of which was a low cape, the English burying-ground of later days, with a cove behind it, "having shelter from all winds," and "a little creek like a harbour." They

* 79° 42', says De Veer, who gives the elements of the calculation. Barendsz's log says 79° 24', but this is doubtless a misprint.

† Not Spitzbergen, as it is commonly but incorrectly spelt. The name is Dutch, from *spits*, "a point."

landed, and found two walrus' teeth "that waighed sixe pound," and many smaller teeth, so they named the inlet Teeth bay. On this occasion they appear to have taken formal possession of the land for Holland, and to have deposited among some rocks a record of their visit enclosed in a box.*

On the 26th they sailed into the north end of Foreland sound, but found that it was blocked at some distance in by the banks afterwards called the Barr. There was ice on the shallows, so they were forced to turn back, for which reason they called the sound Keerwyck.† On Barendsz' map this bank is marked as an isthmus, joining the Foreland to the mainland, but from his log it is evident that he knew there was water over the bank. The next day was calm, but on the 28th they emerged again from the sound and rounded the north end of the Foreland, to which they gave the name Vogelhoek, from the great number of birds about, which flew against the sails. On the 28th they sailed southward along the west coast of the Foreland, "which was very mountainous and sharp, with a beautiful shore." At noon the latitude was observed to be 78° 20′. Later they passed the mouth of Ice fjord, "a large bay, which extended itself in the land east-north-east, and was on both sides high and mountainous;" afterwards they saw Bell sound, "in which was much ice under the land." These are the bays named Grooten Inwyck and Inwyck on Barendsz's chart. They continued southward along the land, till at noon on the 29th they were in lat. 76° 50′ N. The ice now drove them out to sea. At noon on the 30th they were in lat. 75° N., and on July 1 they sighted Bear island once more.

It is evident that between Barendsz and Rijp there had been frequent differences of opinion as to the course to be steered. Rijp was always for going further west, Barendsz hankered after the east. Their differences now culminated, and they decided to separate and go their own ways. Barendsz sailed to Novaja Zemlja, where, after following up the west coast and rounding the north-east point, he was shut in by ice at Ice haven on August 27, and forced to winter. On the 30th the ship was nipped in the ice, "whereby all that was about and in it began to crack, so that it seemed to burst into a hundred peeces, which was most fearfull both to see and heare, and made all the haire of our heads to rise upright with feare." They now began carrying things ashore, where they set up a tent, and presently, having found much driftwood, determined to build a hut. The carpenter died on September 23, leaving them sixteen in number, whereof some were always sick. By the end of October the house was finished, and they had moved into it.

* See the affidavits printed by Müller, 'Geschiedenis der Noordsche Compagnie,' p. 362.

† See A. Cz. Herman's affidavit of 1630, printed in Muller's 'Geschiedenis der Noordsche Compagnie,' p. 363.

During the winter only one man died, though many suffered from scurvy, but the fresh meat they secured by trapping foxes saved them. When daylight returned they "made (April 3) a staff to plaie at Colfe,* thereby to stretch our jointes;" and it is again recorded (May 15), that they went out "to exercise their bodies with running, walking, playing at colfe, and other exercises, thereby to stirre their joynts and make them nymble." They had many contests with bears, and once, like so many other early arctic travellers, they ate a bear's liver, which made them all sick so that their skins peeled off. All through the month of May they waited, hoping to be able to bring their ship away; but it was not possible; so they made preparations for leaving in two open boats, and Barendsz, who was very ill with scurvy, wrote a letter, which he put into a bandoleer and hanged up in the chimney, stating briefly the nature of their doings and sufferings in that place.

At length, on June 13, they drew Barendsz and another very sick man to the shore, and embarked in the two open boats, fifteen men in all. They rowed round the north-east point of Novaja Zemlja, and began making their way with great difficulty down the west coast. On the 20th, near Cape Comfort (east of Cape Nassau), "Claes Andriezoon began to be extreme sick, whereby we perceived that he would not live long, and the chief boateson came into our scute and told us in what case he was, and that he could not long continue alive; whereupon Willem Barendsz spake and said, 'Methinks with mee too it will not last long;' and yet we did not judge Willem Barendsz to be so sicke, for we sat talking one with the other, and spake of many things, and Willem Barendsz looked at my little chart, which I had made touching our voiage, and we had some discussion about it; at last he laid away the card and spake unto me, saying, 'Gerrit, give me some drinke;' and he had no sooner drunke but he was taken with so sodain a qualm, that he turned his eies in his head and died presently, and we had no time to call the maister out of the other scute to speak unto him; and so he died before Claes Andriesz, who died shortly after him. The death of Willem Barendsz put us in no small discomfort, as being the chiefe guide and onely pilot on whom we reposed our selves; but we could not strive against God, and therefore we must of force be content." Thus died the discoverer of Spitsbergen, and leader of the first polar expedition that wintered so far north. A third man died a few days later.

With incredible toil the weak survivors, all more or less scurvy-

* It may interest golfers to be reminded that many representations of their game exist in works of art by Dutch painters of the seventeenth century. I remember two, both dated 1654. One is a drawing of golf-players by Jan van de Capelle in a sketch-book (which also contains drawings by Rembrandt and other contemporary artists), which belonged to Madame Kneppelhout in 1891. The other is an etching by Rembrandt (B. 125), representing the sport of "Kolef."

stricken, laboured through the ice, till the 19th, when they came into open water near Cross island. Sailing now more quickly southward, they met two Russian Lodyas on the 28th, and obtained a little relief from them. Shortly afterwards they found scurvy-grass, which did them all incredible good, but the scurvy was not entirely cured till much later. Sailing straight across the sea, they reached the mouth of the Petchora on August 4. On September 2, after voyaging 1600 miles in their open boats, and undergoing innumerable hardships, being often brought to the verge of starvation, they joined three Dutch ships at Kola, on the White sea, whereof, by a strange chance, one was under command of the selfsame Jan Cornelisz Rijp from whom they had parted thirteen months before at Bear island.

Of Rijp's doings after parting from Barendsz, we possess, unfortunately, the most meagre accounts. Hessel Gerritsz, in his 'Histoire du pays nommé Spitsberge,' only says, "Rijp again set sail (*i.e.* from Bear island) towards the north, and came, after marvellous accidents from ice and winds, to the spot where they had anchored for the first time in 80° (*i.e.* to Fair haven). He had also been again at Vogelhoek, and he returned from thence with the intention of rejoining Barendsz." Pontanus, in his 'History of Amsterdam,' says (p. 168), "that Rijp pretended that they ought to retrace their steps till 80°." Rijp himself, in his affidavit, only says that "they returned to the same place where they had been at first," and that, from Bear island, they "took their course to the north round" Spitsbergen. There is every reason to believe that they merely retraced their former course, and made no new discoveries, the ice-pack near Fair haven keeping them back. If any discoveries of importance had been made they would assuredly have been included in the chart of 1598, whereas nothing is there indicated, and Rijp's returning ship is merely depicted in the neighbourhood of the Faroe islands. De Veer says that Rijp left them to "saile unto 80 degrees againe; for hee was of opinion that there he should finde a passage through, on the east side of the land that lay under 80 degrees"—that is to say, that he did not intend to explore eastward till he had reached Fair haven.

From Kola, Rijp carried the twelve survivors safely home to Holland. They entered the Maas on October 29, rowed to Delft, then to the Hague, and from thence to Haarlem; "and upon the first of November about noone got to Amsterdam, in the same clothes that we ware in Nova Zembla, with our caps furd with white foxes skins. . . . Many men woundred to see us, as having estemed us long before that to have bin dead and rotten. The newes thereof being spread abroad in the towne, it was also carried to the Princen Hof, where the noble lords, the Chancellor, and the Ambassador from the most illustrious King of Denmark, Norway, Goths, and Wends, were then at table. For the which cause we were presently fetcht thither by the Schout and two of the lords of

the town, and there in the presence of the said lord ambassador and the burger masters we made rehearsall of our voyages and adventures."

This memorable and tragic expedition became famous in the annals of Dutch navigation, and is still rightly regarded as one of the glories of Holland's heroic days. Hendrik Tollens wrote a poem upon it. De Veer's account of it was widely circulated, translated into many languages, and has been frequently reprinted, twice in English during the last century. Not till the year 1870 was Novja Zemlja circumnavigated; Captain Johannesen accomplished this feat, and visited the east coast of the island, when he approached but did not find Barendsz's winter quarters. In 1871 another Norwegian, Captain Elling Carlsen, of Hammerfest, took his sloop into Barendsz's Ice haven on September 7. On the 9th he discovered the ruins of the hut (16 metres long by 10 metres broad), and brought away from it a number of relics, which had been buried and preserved under a thick accumulation of ice. Measures were successfully taken by the Dutch Government to obtain possession of these treasures. They were presented to Holland by their purchaser, Mr. Kay.* Captain Gundersen was the next to visit Ice haven in 1875. He found and brought away some old charts and manuscript translation of the narrative of Pet and Jackman's voyage of 1580. Finally, in 1876, Mr. Charles Gardiner sailed in his yacht *Glow-worm* through Matotchkinshar to Ice haven, and made a thorough examination of the ruins of Barensz's hut. He brought back one hundred and twelve more relics, which he generously presented to the Dutch Government.† All these objects were brought together, and form the interesting collection now exhibited in the museum at Amsterdam.

BELLINGSHAUSEN'S ANTARCTIC VOYAGE.‡

By HUGH ROBERT MILL, D.Sc.

EIGHTY years is a long time to wait for an authentic account of one of the most remarkable and important of antarctic voyages; yet until the publication of this slim volume, only the few students of these matters who have an intimate acquaintance with the Russian language were able

* J. K. J. De Jonge: Nova Zembla: De Voorwerpen door de Nederlandsche Zeevaarders na hunne overwintering aldaar in 1597, achtergelaten en in 1871, door Kapitein Carlsen teruggevonden. The Hague, 1873. 8vo.

† J. K. J. De Jonge: Nova Zembla: De Voorwerpen door de Nederlandsche Zeevaarders na hunne overwintering, op Nowaja-Zemlja bij hun vertrek in 1597 achtergelaten en in 1876, door Chs. Gardiner, Esq., aldaar teruggevonden. The Hague, 1877. 8vo.

‡ F. von Bellingshausens Forschungsfahrten im Südlichen Eismeer 1819–1821. Auf Grund des russischen Originalwerks herausgegeben vom Verein für Erdkunde zu Dresden. Leipzig: S. Hirzel. 1902. Pp. 204.

to get at the full details of the voyage of the two Russian corvettes in 1819–21. Unfortunately the full details have still to be sought in Russian, for the 200 octavo pages now published by the Dresden Geographical Society concentrate a narrative which spreads over 730 quarto pages of the Russian original. We greatly regret that this condensation was necessary, the more because we find in the preface that Prof. H. Gravelius, to whom the translation is due, dictated a full translation of Bellingshausen's two volumes to a shorthand-writer, which was equivalent to 640 octavo pages, and then proceeded by judicious excision and compression to bring the mass of matter within the means of the Dresden Geographical Society to publish, "the fourth redaction—and reduction—of the original translation." This is a work of no mere local or temporary interest, and we wish that it had been possible to have secured the co-operation of larger and wealthier societies, in more countries than one if that were necessary, so that the whole text might have been laid before the people of Western Europe. Perhaps it is not too late to secure a full translation; perhaps we might hope that some one of the several wealthy promoters of antarctic research might give the few hundreds required for a full translation into English, illustrated with a map—which is wanting here though the original work had one—and helped in places by notes.

Yet we do not wish to detract from the immense credit due to Prof. Gravelius and the Dresden Society, for their book is most judiciously condensed, and, as far as we can test it—that, unfortunately, is but a little way—very accurately rendered. It is certainly of engrossing interest and, despite the remote date of the voyage, of refreshing novelty. We have, in fact, no criticism to offer, except that it might have been stated whether the dates are according to new or old style; they are given as in the original, and so must follow the Russian calendar. In referring to dates in this notice, we quote from the book, and eleven days must be added to make them correspond with the dates marked on Bellingshausen's track on the map given in the 'Antarctic Manual.' The temperatures might perhaps have been reduced to a common scale—some are cited in Réaumur, others in Fahrenheit degrees; but here again the translator follows the author. Without further comment we shall summarize the main facts as to the voyage, calling special attention to those parts least noticed in the brief and unsatisfactory accounts with which we have had to be satisfied hitherto.

The Russian emperor, probably on the advice of Baron de Traversey, the head of the Russian admiralty, resolved early in 1819 to send out two expeditions of two ships each simultaneously towards the two poles. The idea was imperial in its world-embracing magnitude, and autocratic in the speed with which the four vessels were selected, equipped, manned, and despatched.

The Emperor Alexander I. visited the vessels when they were

ready to sail, and entertained the captains at the palace before their departure, impressing on them his desire that they should act in the friendliest way towards all people, civilized or savage, whom they should meet. On July 4, 1819, the four ships sailed from Kronstadt, the *Otkritie* and *Blagonamerenni* bound for the Pacific to enter Bering strait and make the north-west passage; the *Vostok* and *Mirni* for a voyage in the south supplementary to that of Captain Cook. The *Vostok* was a corvette built at St. Petersburg in 1818 of unhewn pine-wood; she was copper-bottomed, and her masts and spars cut down to fit her for heavy weather. Her dimensions are given as—length, 129 feet 10 inches; breadth, 32 feet 8 inches; and depth, 9 feet 7 inches. These figures are accurately transcribed from the original, but the important qualifying word "of hold" after "depth" is not translated; the draught of water must have been greater. The second was a vessel of 530 tons, built of the same material as the *Vostok*, and, under the name of the *Ladoga*, intended for the navigation of the Baltic; she was, however, specially strengthened. The emperor changed the name to *Mirni*, *i.e.* "Pacific," and her dimensions were—length, 120 feet; breadth, 30 feet; and depth (this time probably draught of water), 15 feet. She was a much slower sailer than the *Vostok*, and the narrative is full of records of the leading ship having to shorten sail in order to allow the *Mirni* to come up with her. Captain F. von Bellingshausen (who had made a circumnavigation with Krusenstern) had received his appointment to command the expedition on board the *Vostok* on April 24 at Sebastopol; it took him a month to reach St. Petersburg, so that his time for preparation was barely six weeks. The command of the *Mirni* was given to Lieut. Lazareff, who had served in the British navy for four years as a volunteer officer, and had since commanded one of the ships which kept up communication between Russia and Alaska. The *Vostok* carried 117 souls all told, including an astronomer and an artist; none of the work of the latter, however, illustrates this work, but it appears in the atlas accompanying the original narrative. The *Mirni* had a complement of seventy-two; no chaplain is mentioned in the list of officers of either ship, but there was a priest on board the *Mirni*, who visited the *Vostok* when weather permitted, and on the two vessels parting company for a time he was transferred to the bigger ship, where he could minister to the larger congregation. Two German naturalists were engaged to join the expedition at Copenhagen, but they evidently got frightened, and refused to join, sending very transparent excuses instead, and Bellingshausen tried desperately to fill their places, but in vain. On July 29 the ships anchored in Spithead, and Bellingshausen took coach to London to buy charts, books, and instruments. He was introduced to Sir Joseph Banks, the former shipmate of Captain Cook, and then President of the Royal Society, and through him tried to find two English naturalists to take the place of the defaulting Germans, but

a week's labour was given to the search in vain. The expedition waited in the hope of finding naturalists until August 25, and then had to sail without them, to the deep regret of the captain, who keenly realized the magnitude of the opportunities which would be open to him, and of which he would be powerless to take advantage. From a passage in the translation, one might suppose that a Russian naturalist may possibly have been found after all, for we are told that in lodging "the astronomer Simanoff and the naturalist Michaeloff" in rooms opposite to those of the two captains while the ships lay in Sydney harbour, the Mayor of Paramatta jocularly observed that science and navigation should never be separated. On referring to the original, however, we find that Michaeloff is called "painter from nature," and not "naturalist."

The ships touched at Tenerife and at Rio de Janeiro, where they met the Russian arctic squadron bound for Bering strait. A snowstorm was encountered on December 15, in 53° S., and next day South Georgia was sighted. The ships sailed slowly along the south coast, meeting a boat from two British seal-ships, which lay in one of the harbours, and discovering a small off-lying island, which was named after Annenkoff, one of the lieutenants of the *Mirni*. A running survey was made of the south coast of South Georgia, which was sprinkled plentifully with Russian names. The weather was foggy, with constant showers of rain and snow, and on the 17th the ships left the coast, steering for the South Sandwich islands. Halfway across a sounding was taken in 260 fathoms with no bottom, and a temperature observation of 31°·75 Fahr. at 270 fathoms is recorded. In 56° S. the first ice-island was seen rising 180 feet above the sea, and covered with penguins, to the great amazement of the Russian crews. Innumerable whales were in sight, and albatrosses accompanied the ships. On December 23 a group of three small islands lying to the north of the Sandwich group was discovered, and named collectively after Baron Traversey, the Minister of Marine, who had equipped the expedition. One of the islands, named after Savodoffski, the first lieutenant of the *Vostok*, culminated in a remarkable summit, shaped like two SS leaning against each other, a puzzling description to which the translator not unnaturally affixes a query. The crater on this island emitted a thick cloud of vapour, and when landed upon the mountain-side halfway up was found hot to the touch; the warmth and freedom from snow made it the site of a great penguin rookery. An experiment was made in the use of melted ice hewn from the floating masses for making tea, and the result proved highly satisfactory, so that henceforth the ice furnished the expedition's water-supply.

Observations were made at this point with a special deep-sea thermometer enclosed in a sheet-iron cylinder provided with valves, through which the water passed freely as it descended, but was

retained on the ascent. At 220 fathoms a temperature of $-1°$ R. was obtained by this instrument, the surface temperature being $+0°{\cdot}5$ R.; but Bellingshausen had not perfect confidence in the contained water retaining its temperature unchanged. He proved, however, that the water at 220 fathoms was distinctly salter than that at the surface.

The Candlemas islands, Saunders island, and Montague island, discovered by Cook, were passed on their eastern side, and recognized; the two latter had a fine appearance, seen as they were with the sunshine glittering on their covering of snow. The weather speedily relapsed into its normal state of fog and snow-squalls, and for several days the ships tried to make their way southward through an increasing number of bergs. On January 1, 1820, a glimpse of Bristol island was obtained through the fog, but the weather continued so bad that it was impossible for the officers of the *Mirni* to come on board the *Vostok* for a New Year's feast. Next day the land of Southern Thule was sighted, and found to be a group consisting of one large and three smaller islands, all very high and inaccessible. Bellingshausen named the largest member of the group Cook island, in honour of its discoverer. On January 3 the parallel of 60° S. was crossed for the first time, but next day it was necessary to shape a northerly course, as the ice was impenetrable to the south, and the rigging was so encumbered with snow and ice as to make it almost impossible to manœuvre the ships. Southern Thule and Bristol island were passed on their western side, the group being circumnavigated for the first time, and on the 5th the ships were back in the position occupied four days previously.

A fresh attempt was made to get south, as the weather had improved, and with a strong westerly wind a steady course east by south was steered for many hours, affording a welcome rest to the crews, wearied by the incessant tacking of the previous week. On January 8, however, in 60° S. and 18° W., solid ice appeared once more to the south, and a course was held eastward through drifting bergs. The appearance of marine animals suggested the proximity of land, but no other indications were seen. On the 11th it was possible to steer south-south-east, and a slight but distinct swell coming from the south suggested the idea that the sea towards the pole was more open and free from ice than where they were. The Russian ships were now well to the south of Cook's homeward track, and in a stretch of ocean where no other vessel had ever sailed. On January 11, about 12° W., a fresh south-westerly breeze made it possible to set a course south-east through a clear sea, and as the wind veered to north the course was gradually altered to south, until, on January 15, the antarctic circle was crossed for the first time in 3° W. long., and next day the latitude of 69° 21′ S. was reached on the same meridian. It is interesting to notice that when Biscoe passed along the same track eleven years later in the same month, he coasted

the ice-pack on a track almost coinciding with Bellingshausen's. For three days the *Vostok* and *Mirni* tried to work round the projecting promontory of ice which barred the way to the south and east, and on January 19 the way to the south seemed clear; though the ships were smothered in snow and the air-temperature was below 30° Fahr., there was little ice, and whales were blowing all round. On the 21st, however, a vast icefield appeared in the south, and the ships had to turn from a position in 69° 25′ S., 1° 11′ W. to the north-east once more, the circle being crossed northwards on the 23rd. Every moonlight night, when the stars were visible, was taken advantage of for lunar observations on both ships, the resulting longitudes being apparently of very fair accuracy. The eastward route had kept about 5° to the south of Cook's outward track on his vain hunt for Bouvet island, and at last, on February 3, it was possible once more to pass the circle southwards in 18° E., and on the 6th the latitude of 69° 6′ S. was reached in 16° E. Here a sounding showed no bottom at 180 fathoms, the air-temperature was −4° R. (23° Fahr.), and the sea was full of pack-ice, increasing in density towards the south. Whales were playing in the lanes of open water. While the great drifting ice-islands were obviously derived from the land, Bellingshausen satisfied himself that the pack-ice was produced at sea, for with a temperature of 23° Fahr. a month after midsummer, it was evident that the cold in winter must be very severe, while the immense snowfall of those latitudes and the condensation from the atmosphere on the cold ice must at all times of the year tend to increase the volume of the floating masses. Once more it was necessary to turn back, and the circle was crossed northwards on February 8 in 21° E. The weather continued wretched—gales, snow, and a temperature always below the freezing-point.

The last attempt to get southwards led to the crossing of the circle on February 14 in 38° E., the point where Cook had made his first attempt to enter the real antarctic. The declination of the compass was found to have increased nearly 11° westerly since Cook's time. On the 15th the worst storm of the voyage descended on the ships; decks and rigging were covered thick with snow, a terrific sea washed over the vessels, and the greatest anxiety was felt as to the result. For three days the gale lasted, the wind blowing from north and north-north-east, while the snow-showers hid the drifting bergs until the ships were almost upon them, and every rope and spar had a crust of ice 1½ inch thick. The only chance of safety was to beat to the northward in the hope of clearing the ice, and in the end both ships emerged still in company and both undamaged.

On February 20 the ships were in 63° S., 42° E., and they held a due easterly course to 68° E., in order to look for any land in those latitudes that might have been missed by Cook when he made his great *détour* to the north in search of Marion island. Nothing was seen except

occasional floating ice, and, gradually working further north, they crossed the parallel of 60° S. on March 5, in 87° E., close to the point where Cook had crossed it southwards on the return from his northward trip. A few days previously the hundredth day of the voyage from Rio de Janeiro had been celebrated with great satisfaction, for the health of all on board both ships was excellent; but supplies were running low, and it was becoming necessary to revisit some port where they could be replenished. On March 4 an enormous iceberg was in sight, the height of which, as measured by sextant observations from the *Vostok*, was 375 feet, and from the *Mirni* 408 feet.

Bellingshausen now resolved to part company with the *Mirni*, in order to more thoroughly explore the sea south of Australia. He accordingly arranged for a rendezvous at Royal Company island, marked on Arrowsmith's map in 49° 30′ S., 143° 4′ E., towards which point the two ships should proceed on parallel courses 8° apart, the *Vostok* following the more northerly and more direct track. The *Vostok*, having taken the priest on board, and being no longer obliged to shorten sail for her slower consort, made a quick voyage to the reported position of Royal Company island, which was reached on March 22, but neither island nor *Mirni* was to be found. Two days later the coast of Van Dieman's Land came in sight, and on the 29th the *Vostok* anchored in Sydney harbour, after a voyage of 131 days. The *Mirni* had not arrived; but the arctic expedition in the *Otkritie* and *Blagonamerenni*, which sailed on the same day from Kronstadt and were left in Rio, were again encountered on their leisurely voyage to Bering strait.

At Sydney the Russians received a most hearty welcome, and Bellingshausen speaks with great cordiality of the generous kindness shown by the governor, General Macquarie. On April 7, when being shown the new lighthouse on the South Head, the Russian officers had the pleasure of seeing the *Mirni* enter the harbour, all well with the exception of one sailor, who showed some symptoms of scurvy.

The two ships lay in Sydney harbour for a month, making various repairs and taking in fresh stores, and then sailed for a long cruise in the tropical Pacific, exploring the island groups, especially the Paumotus, then scarcely known, discovering several new islands, and penetrating as far as Cook's great place of refreshment, Tahiti, where King Pomare, an independent monarch under British influence, received them with graceful hospitality. They were back in Sydney on September 8 after four months' absence, and here Bellingshausen learned from the Russian consul of the discovery of the South Shetlands by William Smith in 1819, a fact of some little moment as bearing on the credibility of the American sealer Fanning, who states that Bellingshausen believed he had made a discovery when he sighted the New Shetlands, until Captain Palmer told him what they were.

On October 31, 1820, the *Vostok* and *Mirni* left Sydney harbour for their second visit to the antarctic regions. On November 17 they were off the Macquarie islands, and experienced an earthquake shock while in more than 50 fathoms of water. On the 27th they crossed the parallel of 60° S. in 163° E., and the officers drank the health of their friends in St. Petersburg in 60° N. Next day the first iceberg was seen, a stately mass with fretted sides that looked as if they were ornamented with statues. Loose floating ice then appeared, and behind it a solid wall of ice, along which they cruised south-eastward. Some ice-islands, one nearly 5 miles in circumference, appeared beyond, and at first this was mistaken for land. The sea seemed most open to the east, and so Bellingshausen kept eastward along the edge of the solid ice, until on November 30 he almost touched 65° S. in 169° E. Then the fine weather ceased, the margin of the ice turned to a north-easterly trend, and the ships worked their way with care and difficulty through the loose pack and icebergs, of which more than a hundred were in sight at one time. The ships, Bellingshausen says, were far too weak to risk any severe pressure in the ice, a hint which shows that he had at least some wish to attempt to penetrate the pack, though he could have no idea of the great expanse of open sea along the coast of the undiscovered Victoria-land which it sealed up. For four days he had skirted the margin of the impenetrable ice, for a distance of 380 miles, and just when the end of it seemed to be reached a frightful storm came on. To add to the misery of the gale and the darkness, the wild rolling of the ship shook masses of snow and ice from the rigging, which fell on the deck and made it dangerous to move about. The birds brought from the tropics as pets were dying daily in the severe climate, but the polar birds native to the region appeared in increasing numbers, always suggesting the proximity of land.

At last, on December 13, the polar circle was reached again in 164° 34′ W., and the midnight sun was seen; but next day the ships were almost beset in a field of loose floating blocks of ice not more than 5 to 7 feet thick, and recalling the familiar ice-floes of the Baltic. It was necessary, however, to retreat northwards, but the belief that behind this floating ice solid land existed seems to have been strong in the minds of the officers. The weather was a succession of gales and fogs, the edge of the ice turned the ships further and further north as they proceeded eastward, and just in the longitudes where Cook sailed for 13° within the antarctic circle Bellingshausen was forced to within a mile or two of the sixtieth parallel in order to get round the ice, yet he was a fortnight later in the season than Cook. It was observed that a bank of fog formed over the large bergs, so that they could be recognized by the cloud that capped them even when they themselves were below the horizon. On Christmas Day (Russian calendar) 244 icebergs were in sight, and the commander congratulated himself that both

crews were in excellent health, better than they had enjoyed in the tropics.

On the meridian of 135° W., where Cook had run north to refresh his exhausted crew, Bellingshausen was able to turn southwards, and on December 30 he crossed the circle, only to be turned back in 67° 30′ S., 120° W., by solid ice. Another northward bend brought the ships to the longitude where Cook had made his farthest south, but, as Bellingshausen considered it unnecessary to follow the track of his predecessor, he changed his course to south-east, crossed Cook's route, and crossed the circle for the sixth time on January 7, in 104° W. A south-easterly course led through a crowd of ice-islands, one of them about 20 miles in circumference and rising 200 feet above the water. On January 10 the farthest south point of the voyage was reached in 69° 53′ S., and 92° 19′ W. At 3 p.m. a dark speck appeared on the white background of ice to the east. All the telescopes in the ship were turned upon it, and various opinions were being expressed, when the sun shone out and revealed it as land without a doubt, the steep cliffs and rocks standing out black and free from snow. The land had appeared suddenly without a warning sign. It was the most southerly known land in the world, the first to be discovered within the antarctic circle. Next day a nearer view was obtained. The land proved to be an island, 9½ miles long and 4 miles broad, lying in 68° 57′ S., 90° 46′ W., and rising to a height variously estimated at from 3961 feet to 4390 feet. It was named after Peter the Great, founder of the Russian navy. It appeared unlikely that such an island existed entirely alone, and a keen look-out soon revealed more land that seemed like a continuation of the island and then vanished in the fog. At this point in the narrative Bellingshausen brings in a long digression describing experiments made a year before on the freezing of sea-water and fresh water, with a couple of pages of speculation as to the formation of sea-ice, and a renewed declaration that the icebergs were not sea-ice, but produced from some great southern land just as the small masses of ice had been seen to detach themselves from the slopes of Peter I. island. On the 15th, still south of 69° S., with an impenetrable pack to the southward, the sea-water was observed to be discoloured, but a sounding gave no bottom at 145 fathoms. Then sea-swallows appeared, a certain sign of land according to Bellingshausen, who wrote, "the land *must* come," and on the 17th it came. It was beautiful weather, the finest day of the whole voyage before or after, and a great peak rose 40 miles to the east-south-east, approximately in 68° 43′ S., 73° 10′ W., beyond a broad stretch of impenetrable ice. It was named after the originator of the expedition, Alexander I. The new discovery was called a land, not an island, for distant snow-free peaks appeared beyond that which was first seen, and its extent seemed to be considerable.

A course was now set for the South Shetlands, with the object of

approaching them from the south and ascertaining definitely whether they had any connection with the conjectural antarctic continent. On January 24 land was seen and identified as the South Shetlands. A number of small islands were named after various victories of the Russians over the French in Napoleon's campaigns. At Little Yaroslav island Bellingshausen found on the morning of January 25 eight British and American sealers lying at anchor, and, having invited Captain Palmer on board the *Vostok*, he obtained from him some particulars as to the work of the hunters. It is somewhat remarkable to find no mention made of the mainland south of the South Shetlands, to which Fanning explicitly states that Bellingshausen gave the name of Palmer land, and to find no mention of the services of Palmer as pilot, to which Fanning devotes some space. No stay appears to have been made, and the north-eastward course was resumed, a few more small islands being sighted and named on the way; the 60th parallel was passed on January 31, and after a time of severe but needless anxiety on account of the Shag rocks, which were passed in a fog, Rio was reached on February 26 and left on April 23. At last, on June 24, 1821, the two ships dropped anchor once more at Kronstadt, after an absence of 751 days, 527 of which had been passed under sail, and the whole distance travelled had been 2½ times the circumference of the Earth.

The voyage had been planned as a continuation of the voyage of Cook, and Bellingshausen seemed to have possessed not a little of the spirit of the great navigator whose labours he most loyally supplemented, even to the extent of foregoing the opportunity of possibly approaching nearer to the pole in order to explore the more open parts of the Southern ocean in the longitudes where Cook had got far south. It is unfortunate that this splendid voyage remained without result; for the course of subsequent explorations would have been the same had it never taken place. A timely translation into English would have facilitated the voyages of Biscoe, Balleny, Wilkes, and Ross.

THE SCIENTIFIC WORK OF THE SWEDISH ANTARCTIC EXPEDITION AT THE FALKLAND ISLANDS AND IN TIERRA DEL FUEGO.

By Dr. J. GUNNAR ANDERSSON.

I. *The Falkland Islands.*—After the return of the *Antarctic*, on July 4, to Port Stanley from South Georgia (see *Geo. Journal*, vol. xx. p. 405), the members of the expedition on board this ship carried on investigations in different parts of the Falkland islands until September 11. The botanist made valuable collections of marine algæ, and to some extent also of land-plants, though the season was very unfavourable

for investigations of this kind. In the shallow bays and harbours of the Falkland islands seventeen trawlings were made, some of which have shown a rich animal life. Also of the lower land and fresh-water fauna (insects, crustaceans, molluscs) a considerable collection has been brought together.

In connection with the geological survey, collections of marine fossils have been made both in East and West Falkland, in the Devonian sandstone, first studied by Darwin, forming the prevailing formation of the islands. Scattered and badly preserved plants have also been found, partly together with the marine fossils. The hitherto unknown base of the Devonian formation has been discovered in Cape Meredith, West Falkland, where the sandstone rests on a highly disintegrated formation of gneiss and granite.

Special attention has been devoted to these grand phenomena so characteristic of the Falkland islands, which have been described as "stone-rivers." A detailed survey of one of the largest stone-rivers has proved that we have here on a large scale a peculiar mode of detritus-transport, previously described by the author from the arctic region (Bear island). The formation of the stone-rivers belongs to a past period, and it seems very probable that it ought to be regarded as a subglacial facies of the ice-age. In that time, when Tierra del Fuego, South Georgia, and the Dirk-Gerritsz archipelago were under their maximum glaciation, there probably existed in the Falkland islands a climate not favourable to the formation of glaciers, but in winter-time permitting the deposition of a thick snow-cover, which, when melting in summer-time, caused a slow but extended movement of the detritus downhill.

We have found in the Falkland islands evidence both of a submergence and of a greater elevation than exists at present. Small river-valleys, the lower part of which is now submerged under the surface of the sea, forming numerous creeks all round the coasts of the main islands, indicate that this archipelago before the ice-age (in the time of the stone-river formation) was elevated at least 30 to 50 feet above its present position, while on the other side raised beaches (terraces and shingle-covered plains) prove that these islands in a post-glacial period have been submerged at least 210 feet below the present sea-level.

II. *Trawlings on the Banks between the Falkland Islands and Tierra del Fuego.*—On the passage between the Falkland islands and Tierra del Fuego, September 11–15, five trawlings were made on the coast banks and the Burdwood bank, the fauna of which was hitherto very little known (south of West Falkland, 100 fathoms; the Burdwood bank, 80 fathoms; three trawlings; eastern entrance of Beagle channel, 50 fathoms). These trawlings yielded an extraordinary rich result, in which were to be observed hydroids with large luxurious colonies,

belonging to several species; corals, ophiurids, asteroids, etc., with the most beautiful forms and colours. The most valuable find, according to the report of the zoologist, Mr. K. A. Andersson, are some colonies of that very remarkable *lcphalodiscus*, discovered in 1876 by the Challenger Expedition in the Strait of Magellan, but never found afterwards. Once before *lcphalodiscus* had been found by our expedition, viz. on January 16, 1902, at Cape Seymour (lat. 64° 21′ S., long. 56° 46′ W.), at a depth of 80 fathoms.

III. *Tierra del Fuego.*—Here our expedition has been working, first in the month of March, 1902, before the departure for South Georgia, then since September 15, the investigations being not yet concluded. If an excursion to Lago Fagnano, in the interior of Tierra del Fuego, is left out of consideration, all our operations have been limited to the Beagle channel. There may be mentioned a visit to the small isolated occurrence of the Tertiary formation in Slogget bay (eastern entrance of the Beagle channel). The Tertiary beds here rest upon disintegrated rocks belonging to the Cordillera series. The deposits of the ice-age, hitherto unknown from the south-eastern part of Tierra del Fuego, have been observed in Slogget bay, at the eastern end of Lago Fagnano, in a river-valley at the north side of the Cordillera and in the neighbourhood of Harberton harbour. In all these places there occur, in connection with the moraine stratified sediments, coarse gravel and sand of considerable thickness, and evidently of fluvio-glacial origin.

Very instructive was the splendid section in the 120-feet-high *fairauca* on the west side of Gable island in Beagle channel. The lower part of the section consists of stratified sediments, coarse gravel with intercalations of beds of sand, the whole presenting fine discordances. On these stratified sediments, the largest visible thickness of which was found to be 75 feet, there rests a mass of typical moraine clay, without any sign of stratification. The largest thickness of the moraine observed was 45 feet. In this moraine clay were found some fragments of fossils (mussels and balanids). This find indicates that the ice-stream which once filled up Beagle channel has mixed in with its moraine *débris* of Tertiary or Quarternary (pre- or interglacial) marine beds, that is, sediments which are not yet known from this region.

The botanical investigations have yielded considerable collections of marine algæ. As regards the land flora, the higher mountain regions especially have given a good result. Zoological trawlings have been made in the Beagle channel in fifteen localities, and in depths from 120 fathoms to the littoral zone. Two of the largest lakes of Tierra del Fuego, Lago Rosa (Arigami) at Lapataia bay, and Lago Fagnano in the interior, have been made the objects of zoological investigations. Two of the members of the expedition, Messrs. K. A. Andersson and Skottsberg, visited Lago Rosa on October 8 to 13, made collections of the fauna and vegetation of the lake, and sounded very considerable depths down

to 45 fathoms. The excursion to Lago Fagnano started from Harberton on the Beagle channel, and went through a pass in the Cordillera. In this region three young pioneers, Messrs. Bridges, sons of the well-known English missionary, have, with a subvention from the Argentine Government, cut a horse-track through the forests. In this road I brought with the assistance of Ona Indians, a canvas boat to Lago Fagnano, and made from it zoological collections in the eastern part of the lake.

Since the *Antarctic* has in Ushuaia been completely fitted out, we leave for the south early in November. At first we intend to make cartographical, geological, and biological investigations at the South Shetland islands and in Orleans inlet. About December 10 we expect to arrive at the winter station of the expedition on Snow hill. The second part of the summer voyage will be arranged by the leader of the expedition, Dr. Nordenskjöld.

Our expedition has received most valuable support from the Argentine Government. Twice we have received in Ushuaia free of expense a supply of coal, and now, moreover, a considerable quantity of reserve provisions. This generosity has made us deeply indebted to a nation which has also directly taken part in the great antarctic scientific co-operation by erecting a station on Staaten island, and by sending an officer of its navy to winter with Dr. Nordenskjöld.

Harberton, Tierra del Fuego, October 31, 1902.

MAJOR DELMÉ RADCLIFFE'S MAP OF THE NILE PROVINCE OF THE UGANDA PROTECTORATE.*

Note by Sir HARRY JOHNSTON, G.C.M.G., K.C.B.

THAT portion of the Uganda Protectorate which is styled the Nile Province has never, until quite recently, received anything like a systematic survey. None of the work done under Sir Samuel Baker, Gordon Pasha, or Emin Pasha was of an accurate nature. The late Colonel Vandeleur laid the foundations of something approaching systematic geography in Uganda and Unyoro, but the Nile Province in 1895 was far too unsettled and distant for Colonel Vandeleur to extend his work in that direction. The expedition under Colonel J. R. L. Macdonald, which did so much to increase our knowledge of this protectorate, confined its work to the regions east of the Nile Province, so that when the writer of these lines came on the scene as Special Commissioner in 1899 he found the greatest difficulty in shaping any military or civil policy north of the Victoria Nile, or determining what steps should be taken to finally extinguish the mutiny of the Sudanese

* Map, p. 220.

soldiers (who had retreated north from Foweira), because no positive information existed regarding the geography of the country—the existence and course of its rivers, or the height and disposition of its mountains. He therefore asked Major C. Delmé Radcliffe, who had recently been made both senior military officer and civil administrator of the Nile Province, to commence a systematic survey with such instruments as were available. The work done by Major Delmé Radcliffe is shown by the accompanying map. It is a valuable addition to our knowledge of the definite geography of the Uganda Protectorate. For the first time the middle course of the river Acha (Asua) is laid down. The river Kokolle, which enters the Victoria Nile a little distance above Foweira, is also mapped. A great deal of accurate information has been added to our knowledge of the rivers Ayuge and Unyame, which enter the Nile in nearly parallel courses at the commencement of the Dufile rapids. For the first time also in the history of Nile discovery, the White Nile is accurately figured from its exit from Lake Albert to Dufile, and it is important to observe what Major Radcliffe brings out so well on his map—how lacustrine is this section of the river. In the history of Nile exploration it is interesting to remark how long this piece of the Nile has remained unmapped—namely, from Dufile on the north to Lake Albert on the south. All the earlier explorers generally quitted the Nile at Gondokoro, or somewhere between Gondokoro and Dufile, and struck right across country through the lands of the Madi Acholi and Lango till they reached the Victoria Nile. Subsequently the navigable nature of the Nile between Dufile and Lake Albert was realized, but apparently no one took the trouble to map it with any approach to accuracy.

Major Delmé Radcliffe founded the Government station of Nimule, which is now the military headquarters of the Nile Province. He has also done a great deal to transcribe accurately the correct native names of places, mountains, and rivers. He has been obliged to retain in some cases the old incorrect form which use and custom have sanctioned. In most of these instances this incorrectness is due to the Arab pronunciation, which has turned all the *p*'s into *f*'s. A very curious feature about the northern Bantu languages in the Uganda Protectorate is their strong dislike to the consonant *p*, which, indeed, scarcely exists in indigenous words. On the other hand, the Nilotic languages which border on the Bantu have no objection to this consonant. It would seem, however, as though the Bantu dislike to the *p* is a recent feature, and that we may trace in parts of the Nile Province which Major Delmé Radcliffe has surveyed traces of old Bantu place and tribal names long since overlaid by Nilotic forms of speech. Among these place-names the locative *pa-* prefix of the original Bantu tongue is frequently met with. Major Delmé Radcliffe has pointed out to the writer of these few lines that the proper pronunciation of Foweira is

Pawera; of Fajao, Pajao; of Fatiko, Patiko; and so forth. No doubt the Bantu speech crossed this Nile Province at some remote period, and left behind it the locative *pa-* prefix in connection with many place-names.

BARTHOLOMEW'S SURVEY ATLAS OF ENGLAND AND WALES.*

THE Ordnance Survey maps, owing to their great accuracy, amount of detailed information, and general excellence, must naturally form the basis of any work dealing with the topographical features of the British Isles; but the large number of sheets required to represent any considerable area render them to a great extent inaccessible for general reference to many persons, and unsuited for the study of any extensive district as a whole. It is therefore most important that carefully executed reductions should be published, and this work for some years past Mr. J. G. Bartholomew has been engaged upon, with most satisfactory results, his maps on the scale of 2 miles to an inch having deservedly obtained a very high reputation.

The publication of his admirable atlas of Scotland seven years ago gave rise to a very general desire for one of a similar character of England and Wales, and it was arranged that such a work should be taken in hand as soon as possible. Being assured of the advisability of such an undertaking, after consultation with Mr. Bartholomew and inspecting specimens of his cartographical productions, the Council of this Society consented to allow the atlas to be published under its auspices, and judging from the excellency of the maps contained in this first part, which has just appeared, there is every reason to believe that the work will be quite equal to expectations, and that the confidence of the Society will be fully justified.

As in the case of the atlas of Scotland, the greater part of the present work consists of a series of sheets, numbering sixty-seven altogether, reduced by permission from the new Ordnance Survey maps to the scale of 2 miles to an inch. In addition to showing towns, villages, roads, railways, and other information of a general character, which has been judiciously selected, the special feature of the sheets is the admirable manner in which the relief of the land is indicated by a combination of contour lines and tinting. Those already acquainted with Mr. Bartholomew's reduced Ordnance Survey maps, and have had

* The Survey Atlas of England and Wales. A Series of Eighty-four Plates of Maps and Plans, with Descriptive Text, illustrating the Topography, Physiography, Geology, Climate, and the Political and Commercial Features of the Country. Designed by and prepared under the direction of J. G. Bartholomew, F.R.S.E., F.R.G.S. John Bartholomew & Co., The Geographical Institute, Edinburgh. Under the patronage of the Royal Geographical Society. 1903.

occasion to use them practically, will be in a position to judge of their remarkable clearness, the care taken in the selection of the tints, their accurate registration, and general merits; and to state that the sheets in the present atlas are up to the standard of those previously published is in itself sufficient recommendation. The number of the contours and tints employed upon each sheet must, of course, depend upon the topography of the district represented, but upon those contained in the present part there are from sixteen to eighteen, ranging from sea-level to altitudes exceeding 3500 feet. The low-lying lands from sea-level to 400 feet are shown in four tints of green, and after that shades of burnt sienna are employed, with a general effect that is on the whole most satisfactory. A great deal can be learnt from a careful study of these maps, not merely concerning the physical features of the country itself, but in connection with the influence of these upon the location of towns, and the distribution and industrial and commercial development of the population. Preceding these large-scale detailed sheets, the atlas will contain eleven maps of a general and physical character, exhibiting the bathy-orographical features of England and Wales, the geology, the distribution of vegetation and agriculture, meteorology, railways, density of population, parliamentary and ecclesiastical divisions, as well as others devoted to the commerce and industry of the country. Many of these will be extremely interesting and especially important, inasmuch as they have been prepared from the latest available sources of information, whilst the fact that those dealing with the orography, geology, and meteorology, together with the text accompanying them, have been revised by Sir Archibald Geikie, Dr. Alexander Buchan, and other specialists, is sufficient guarantee of their trustworthy nature. The population, agricultural, industrial, and other statistical maps and text have been compiled from the census of 1901. The last six sheets in the atlas will consist of the following plans: No. 79, London; 80, County of London; 81, Liverpool and Manchester; 82, Newcastle, Hull, Bradford, and Leeds; 83, Sheffield, Nottingham, Birmingham, and Leicester; 84, Bristol, Portsmouth, Plymouth, and Brighton; and in order to ensure accuracy, each of these has been submitted to local surveyors and others for careful revision. After these plans will follow descriptive and statistical text.

It is the intention of the publishers to issue the whole work in twenty-one monthly parts, at 2*s.* 6*d.* each, or £2 12*s.* 6*d.* for the complete atlas. The first part, which has just appeared, contains the title, preface, list of plates, after which follow three sections of the 2-miles-to-an-inch map, containing VI. Carlisle and Keswick, VII. Barrow and Windermere, XV. Anglesey and Conway, and a plan of the County of London, showing boroughs.

There can be no doubt that this atlas will meet a long-felt want, and be greatly appreciated by many.

THE VOLCANIC ERUPTIONS AND EARTHQUAKES.

During the last two months a large amount of additional information has been received both with regard to volcanic and seismic occurrences already reported, and to more recent disturbances. Continuing its investigations in Martinique, the commission headed by M. Lacroix reports that a new cone, higher than the former summit of the mountain, had formed in the crater of Mont Pelée, and that in consequence of the undermining and shattering of this cone, quantities of hot volcanic material had filled the upper valley of the Rivière Blanche, entirely blocking it. Despatches from the governor of the Windward islands stated that the eruption of the St. Vincent Soufrière on October 15 and 16 had increased the area of devastation. No part of the island was really safe, and the question of abandoning it altogether had to be seriously considered.

According to Mr. J. P. Quinton, who ascended the Soufrière with a party on October 28, the chief activity was in the old crater, which was discharging stones and ashes, with volumes of steam, but no lava; the crater had increased in width and become more funnel-shaped, and the steam was issuing from a fissure in its southern wall. Both Mont Pelée and La Soufrière were in violent eruption on November 26. Mont Pelée was again active during the first week in December. A fresh eruption of La Soufrière occurred on December 18, and on December 27 Mont Pelée once more broke out, ejecting dense volumes of smoke and quantities of dust.

Further details about the Kashgar earthquake of August 22, published in the *Standard*, quoting from the *Turkestan Gazette*, state that the town of Nijni-Artish was destroyed, engulfed in immense fissures, and 1700 lives were lost. Six hundred persons were killed at Kashgar, and the village of Besh-Kerim, with its entire population of about six hundred, was annihilated.

That the eruptions in Guatemala were on an enormous scale appears from information published by a correspondent in the *Times*. We quote from *Nature* of December 11: "On October 24, at about 5 p.m., a violent eruption took place in the ravine which divides the volcano of Santa Maria from that of the Siete Orejas. At 5 a.m. on October 25 subdued noises were heard, emanating apparently from the direction of Quezaltenango. Later on the detonations grew louder. At 6 p.m. the eruption reached its climax. For about an hour the detonations had ceased, when, by a terrific outburst, the whole of the capital was thrown into a panic, and everybody rushed out into the streets. This cannonade lasted for ten minutes, during which time the strongest-built houses shook violently. At intervals the detonations continued through the night, and in a less degree afterwards. The explosions were heard in the south of Nicaragua, and a telegram was received from San Salvador, stating that the inhabitants had rushed into the streets in terror on hearing the noise. Quezaltenango was thirty-six hours in total darkness, during which time a heavy rain of ashes and sand had been falling. The manager of the Saleinas estate, which lies just above the scene of the eruption, says that at about 5 o'clock on October 24 they were alarmed by a series of earthquakes of a throbbing nature, which appeared to come from below them. Almost simultaneously a cloud of steam was seen to issue from the ravine already mentioned, about a league away. Soon after, ashes and sand, accompanied by small stones, commenced falling, and two hours later the odour of sulphur and gases was so great that he could hold out no longer, and he left on foot for Retalhuleu, a distance of some 30 miles. Reports from the other planters confirm the fear that the whole of the Costa Cuca, probably the richest coffee zone in the country, is totally ruined."

Amongst the more recent occurrences are the following. During November it

was reported from Hawaii that the volcano of Kilauea was more active than it had been for twenty years. The volcano on the island of Savaii, Samoa, was stated to be in violent eruption. Explosive eruptions, with ejection of stones and dust, as well as flow of lava, occurred at Stromboli about November 16. Strong earthquakes were felt in Algeria on November 17 and 20.

On December 16, at 9.30 a.m., the town of Andijan, in the province of Ferghana, Russian Central Asia, was entirely destroyed by an earthquake. It is estimated that at that time nearly 16,000 houses were destroyed and 5000 persons killed. On December 23 it was reported that the shocks continued with increasing violence, the disturbed area extending over about 90 square miles. A specially violent shock was felt at 10 p.m. on December 27. A later report on December 28 stated that the earthquake of December 16 affected about 650 square miles; the epicentrum, about 4 miles to the south of Andijan, was indicated by a rent in the earth, from which sand, water, and mud were being thrown up. The statical wave was about 28 inches high, and took a northerly direction. The area of greatest destruction formed a sector, with a radius of about 17 miles, to the south of the town.*

On December 28, at 8 p.m., a severe shock of earthquake was experienced at Syracuse.

The fact that the earthquakes at Schemakha, Kashgar, and Andijan have occurred along a theoretical line of weakness in the Earth's crust lends additional interest to their correlation. It is conjectured that this line sweeps along the Caucasus and crosses the Caspian in an arc, which, instead of continuing its course, is disturbed by a sigmoid flexure, so that a long flattened  occurs with its head near the node of mountains between Kashgar and Andijan, and its tail continued in a long circular sweep up through the Caucasus. This node exists also at the point where the arc would, if undisturbed by the flexure, intersect another arc which sweeps downwards towards the Himalayas round the Tarim basin and Tibet.

The depression south of the Caucasus, on the edge of which the earthquakes occurred which ruined Schemakha, may be compared with the triangular depression of north Ferghana, where Andijan was destroyed; and Kashgar again stands at the edge of the Tarim basin, so that all three places stand on the foothills of folded mountains that border three depressions.

Nature of January 8 reports that "a few days previous to the dreadful event in Andijan a series of slight earthquake shocks was felt at Schemakha, the site of the disaster in February last." So that it appears more and more evident that during the past year we have passed through a period of adjustment in the Earth's crust with world-wide, earth-shaking results, and these adjustments, as in South Australia at the western border of the Flinders range above the depression of the central plain, are at the edges of folds where previous faulting indicates local weaknesses, and that these cracks have long radial extensions such as are seen upon the surface of the moon. The severity of the results of these adjustments along the Schemakha-Andijan line points to a long-continued strain which, once relieved at a point, spread onwards (like a crack in very cold ice that rings across a pond), and

* We are informed by Prof. Milne that the Andijan earthquake of the 16th, as recorded at Shide, Isle of Wight, was not very large, but as it had to travel 50° (5550 kilomètres) to get there, it was undoubtedly severe at its origin. It was of the world-shaking type; the preliminary tremors which passed through the world reached Shide at $5^h\ 25{\cdot}6^m$ a.m., and as they took ten minutes to travel they started at $5^h\ 15{\cdot}6^m$ G.M.T. If Andijan is $4^h\ 49{\cdot}9^m$ to the east, the local time would be $10^h\ 5{\cdot}5^m$. About fifty minutes later there was a second but smaller disturbance.

produced similar fissures, with eruptions of stones and mud, and at Schemakha, where the crack began, a totally new and unexpected extension of lava, where igneous rock was previously unknown.

CAPTAIN FERRANDI'S JOURNEY FROM LUGH TO BRAVA, SOMALILAND.

CAPTAIN UGO FERRANDI was Italian resident at Lugh, on the Ganana (Jub) river, from 1895 till 1897, when he returned to the coast at Brava, accompanied by Dr. Atkinson of Lord Delamere's expedition. His narrative of this journey has lately been published in pamphlet form, under the auspices of the Società di Esplorazione Commerciale di Milano. Leaving Lugh on April 3, he reached Brava on the 22nd, having covered a distance of 220 miles in 108 hours of actual march. His route in the earlier part of his journey lay chiefly over the same red soil as was traversed during Bòttego's last expedition (see *Journal*, vol. viii. p. 516), on which trees grow freely, while the dark soil produces more herbage. The latter, the *ard mado*, covers the territory known as Baidoa, while the *ard godut* lies to the north, in Molimat and Saraman, and yields much larger and better grain (*dhurra*) than the dark earth. The bush was in some places so thick that a path had to be cut with the axe, while in others the arboreal vegetation was scarce, especially in the Ghel-ghel, a plain passed shortly before reaching the Shebeli, which after rain is covered with a carpet of luxuriant dark green grass. No perennial stream was met with, and sometimes there were no permanent water-holes for long distances (30 or 40 miles); but, as several heavy storms occurred, the caravan never suffered from want of water. The wells of Gondut are probably supplied by infiltration from the hills that bound the valley of the Jub. Supplies were also obtained from pools and from holes in dry watercourses. Of these the most considerable is one that nearly surrounds Matagoi, which, descending from the neighbourhood of Mount Egerta and running south-south-west, probably ends in swamps north of the marshes where the Shebeli loses itself. It was full of water when Ferrandi passed. From Derasalle two routes branch off to Sablallo, one past Hol Giri (the well of the giraffe), where there are funnel-shaped holes in the sand more than 20 feet deep, surrounded by *dum* palms, and the other in a more southerly direction, which Captain Ferrandi chose, because it would give him an opportunity of crossing the Webi Shebeli either at Sablalle or at Kumia. At the latter place the passage of the river is easier at high water, for then the Shebeli at Sablalle sends many branches far into the adjoining lands. However, the latter passage was found to be feasible, and the party crossed by means of a boat kept by a Tuni of Brava without suffering any loss, though most of the caravans passing the river pay toll to the numerous crocodiles that infest it. The water is at least 10 feet deep. Between Sablalle and Brava lies the Webi Gof (dry), a branch of the Shebeli said to have been cut off by the Biemal, who are at feud with the Tuni, but probably the mouth of the channel was closed chiefly by silting up. It would be easy to readmit the water into this bed. Animals of all kinds frequent the wells and pools on the route, and also falcons, crows, guinea-fowl, ibis, and partridges. Several dwarf antelopes (*Madoqua Swaynei*) were shot, and water-buck were seen near the Shebeli. Snakes were extremely plentiful, and of one hundred specimens taken all but about fifteen were poisonous. A gad-fly, called by the natives *bal*, was extremely troublesome in the grass lands; while the *ghindi*, the tsetse of this region, frequents the coppices of dum palms along the river. The bite of the *bal*

is very noxious, and even fatal to animals, and therefore the camels of the Doi, the region two days' journey from the Shebeli into the interior, are driven in the dry season to the Sahel, the coastal zone. The people of the Sahel often purchase camels from the Doï district, for they are fine, strong, and fat. These animals, when they see rain in the interior, frequently make off in that direction, swimming the Shebeli, though usually shy of water, to browse on the young shoots of the acacias and mimosas so abundant in the Doï.

The country towards the Jub is occupied by the Rahanwin, a tribe of mixed origin. The Dabarre, now forming a section of the Rahanwin, and settled between Dechie and Matagoi, claim to be of purer Somali blood, and certainly the coarser type with tufted hair, which among the Rahanwin indicates an intermixture with Swaheli or other imported slaves, is not seen among them. The Jidu, dwelling between Kinnia and Matagoi, claim an Arab descent, pointing out the resemblance in sound between Jidu and Jeddah. Their language certainly differs both from the Somali and Rahanwin. They are a pastoral people, and did not cultivate the soil at all before the murrain in 1888 or 1889, which nearly annihilated their herds. Formerly they were the richest Somali in the country, and now their fine cattle find a ready sale at Brava, and their butter (ghee) is exported to Zanzibar. The Rahanwin and Dabarre cultivate white dhurra principally, and also white Turkish wheat and a little cotton. The last crop is fast disappearing in consequence of the introduction of manufactured cloth from the coast. Dhurra is sown about *neïrus*, the Somali New Year's Day, which always occurs in the middle of August, for the Somali year is ten days longer than that of the Mohammedan calendar (354 or 355 days), and the roots, if left in the ground, produce a second crop. When the roots are grubbed up, a second sowing is made in the *guh*, the season before the south-west monsoon sets in. The ears are cut off and stored in silos, where they keep good for years. Field work is performed by slaves, for Somalis are averse to agricultural labour. Many of the farming settlements are supplied with drinking-water by reservoirs (*nar*), generally constructed by damming up a natural hollow. Artificial irrigation is practised only in the neighbourhood of the Shebeli.

REVIEWS.

EUROPE.

Hydrography of Northern Germany.

'Weser und Ems, ihre Stromgebiete und ihre wichtigsten Nebenflusse.' Im Auftrage des preussischen Wasser-Ausschusses herausgegeben von H. Keller. 5 vols. and Atlas. 1901. Berlin: Dietrich Reimer (Ernst Vohsen).

The series of exhaustive memoirs prepared by the Hydrographical Committee of the Prussian Government has been completed by the publication of that on the Weser and Ems. The other members of this series (Oder, 1896; Elbe, 1898; Memel, Pregel, and Vistula, 1899) have been noticed in the *Journal*, and the new volumes present few novel features. We must, however, remark on the astonishing rapidity with which the enormous labour involved in their compilation has been executed, and congratulate the committee on an achievement of great value to geographical science, as well as to engineering. The arrangement of the present work, as in the others, is regional, each river-basin being treated as a separate unit. Although the area dealt with is small, only 9 per cent. of the German empire lying within the basins of the Weser and Ems, the material for its investigation is more abundant than in the case of the other rivers, and hence it has been possible to go into greater detail. Vol. i. gives a general description of the

region; a hundred pages are devoted to its climate, and ninety to its geology, while a second section deals with the rights and privileges of its inhabitants with regard to the rivers and their waters. Vol. ii. describes the sources and tributary streams (excluding the Aller). Vol. iii. gives full details of the hydrography of the Weser from Münden to Geestemünde, and vol. iv. deals with the Aller and the Ems. Vol. v. consists wholly of statistics. In the atlas, which contains thirty-four sheets, are general maps (orographical, meteorological, and geological) on a scale of 1 : 1,000,000, large-scale maps of the river courses (1 : 50,000 and 1 : 100,000), and longitudinal and transverse sections.

The Vosges.

'Les Hautes-Chaumes des Vosges. Étude de Géographie et d'Économie historiques.' Par Pierre Boyé. Paris: Berger-Levrault & Co. 1903.

The upper portions of the Vosges are, as is well known, occupied by pasturages to which the herdsmen of the neighbouring districts annually take their cattle during the summer months, the time which is not actually spent in tending them being devoted to the making of the cheeses for which the district is famous. Dr. Boyé's volume presents an interesting study of these pasturages from a historical and geographical point of view, his conclusions being based on an exhaustive study of the literature and historical documents relating to the region. At the outset he deals with the derivation of the word *chaume*, which is now rarely met with outside the Vosges, though originally it had a more extended meaning, and does not seem to have been used with reference to this district until the fifteenth century. He rejects the idea that the word has any connection with the *Calvi Montes* of historians, and derives it instead from the Low Latin *calma*, which signified "waste ground." In the country itself the word has been employed with varying significations; while on the German side, other terms, such as *Firsten* and *Wasen*, were employed instead, the former alluding especially to the elevated nature of the pasturages, while the latter is the equivalent of *gazon*, "turf." From the point of view of physical geography, the most interesting section is that which discusses the question whether the higher parts of the Vosges have always been bare, or whether the pasturages have been due to the action of man. Dr. Boyé concludes, on somewhat doubtful grounds, perhaps, that the latter is the case, his chief arguments being the spread of the trees over the upper grounds during times of war, when the pasturages were not used, and the assertion which has been made by experts, that similar mountain pastures can only be developed where wood has once been. In subsequent chapters he traces the history of the pasturages from their first-known mention in A.D. 948, entering into details respecting the long-standing questions of proprietorship, and describing the varying fortunes of the industry connected with them. An interesting chapter also traces the gradual exploration of the "chaumes," in which botanists like Tabernaemontanus and Bauhin took a leading part, and draws attention to the feelings of awe inspired by these upper regions, as by those of most mountain ranges in early days.

ASIA.

Borneo.

'The Home Life of Borneo Head-hunters, its Festivals and Folk-lore.' By W. H. Furness, 3rd M.D. Philadelphia: Lippincott Coy. 1902. 8vo, pp. 197, 88 pls. Price 30*s*.

It is not every traveller who can enter so sympathetically into the life of the people he visits as does Dr. W. H. Furness, who, in his recently published book on 'The Home Life of Borneo Head-hunters, its Festivals and Folk-lore,' has proved

himself a charming writer, an accurate observer, and a skilful photographer. Even to the untravelled reader the book appeals by its manifest sincerity, and the literary skill, combined with a wealth of illustrative plates, enable him to realize the daily life of the interior tribes of Sarawak as does no other book. To one who has travelled over the same ground it recalls many similar experiences, and deserves unqualified praise for accuracy alike of fact and of impression. The book is embellished by 88 beautiful heliotype plates of photographs taken by the author. Too often in books of travels one finds illustrations which do not illustrate anything in particular, or which have so little character that they might be equally appropriate for books dealing with other countries; this is not the case in the present instance, and every plate not only illustrates the text, but it contains details of interest to the ethnologist.

There are several distinct groups of peoples in Borneo. In the jungle are nomadic Punans who never build permanent houses, do not cultivate the soil, and who do not appear to have any well-defined social organization. They wander about in small groups, and of all the tribes of Sarawak they are the most mild and gentle, and they are not head-hunters. Dr. Furness gives a pathetic picture of these simple jungle folk, who, perhaps, may be regarded as the true indigenes of Borneo. They are a straight-haired people, and have the lightest tinted skin of any people in Sarawak. Up to the present there is no satisfactory evidence of the presence of a Negrito race in Borneo.

Mainly along the middle reaches of the rivers are to be found the settlements of numerous agricultural tribes, of weak social organization, who have collectively been termed Kalamantans. It is probable that they have been broken up and to a large extent displaced by a more highly organized group of tribes, who are skilful boatmen and brave warriors. These are the Madangs, Kenyahs, and Kayans, and it is with these last two tribes that this book chiefly deals. Possibly this group of tribes is not indigenous to Borneo.

The lower reaches of the rivers at the western end of Sarawak are largely inhabited by the Iban, who are more commonly known as "Sea Dayaks;" the "Land Dayaks" probably belong to the Kalamantan group. The Iban are a turbulent and pugnacious people, who appear to have formed the pagan advance wave of that movement which culminated in the extension of the Islamized Malays over the archipelago which bears their name.

It is not with such problems as these, nor with the physical characteristics of the peoples of Sarawak, that Dr. Furness deals. He restricts himself to the domestic and social life of the people; and in sympathetic description, enlivened with kindly humour, we have presented before us a faithful record of the daily tasks, the recreations, the social observances, the religious duties, the loves and the hates of a people as yet unspoiled by the white man. All the settled tribes of the interior live in long communal houses built on high piles. They cultivate hill rice, and grow a few tubers and other garden produce; they hunt for animal food in the jungle, and do a little fishing. Their weapons are the blowpipe, the spear, and the parang. The steel blades of the implements are smelted by the Kayans and Kenyahs, who prove themselves to be skilful metal-workers. The war-canoes are dug-outs of enormous size, and decorated with an elaborately carved grotesque animal figure-head. A considerable portion of the book is devoted to an account of a war expedition and of the subsequent peace-making, and the description gives a good idea of the methods of native warfare, and at the same time affords an admirable example of the method of government of the Rajah of Sarawak, to whose wise and beneficent rule Dr. Furness adds his meed of praise, as indeed must all those who have the welfare of the native at heart.

Although the natives recognize several gods, they do not pay much attention to them personally, but they constantly take heed of the omen birds and animals the gods send as messengers to warn or encourage mortals. Scarcely anything that is of the least importance can be attempted until favourable omens have been obtained, and how this is accomplished is duly set forth in the book.

Like many "nature-folk," the natives of Borneo are a very artistic people, and various illustrations are given of their skill in wood-carving; but one has to visit their houses and handle their everyday utensils and implements to realize how deep-seated is their feeling for beauty. The methods they adopt to embellish the person are fully described by Dr. Furness. No special objection, even from an European point of view, can be made to the tattooing; but certainly, to our eyes, the artificial dilation of the lobe of the ears, especially great in the women, is decidedly unpleasing. One soon gets accustomed to black teeth, and they do not look amiss even when decorated with brass studs.

Replete as the book is with facts for students of mankind, there is little in it for the pure geographer. There are occasional allusions to scenery, and there is one excellent plate representing the moss-covered jungle on the summit of Mount Dulit (5000 feet), which has already been alluded to by Dr. C. Hose (*Geographical Journal*, vol. i. p. 193).

It is not rash to predict that this book will always be regarded as a standard work on the family life of an unspoiled, honest, simple people, who, despite head-hunting proclivities, are essentially a kind-hearted folk.

A. C. Haddon.

India.

'The Forests of Upper India and their Inhabitants.' By Thomas W. Webber. *With Maps.* London: Arnold. 1902.

Readers who take up this book with the expectation of finding in it a systematic treatise on the forests of India will be disappointed—agreeably or the reverse according to their own particular standpoint. The book is in reality a record of the writer's personal experiences when engaged in work in the Indian forests during the early days of the Forest Administration some forty years ago; and as he was evidently an intelligent and careful observer, and, in addition to his professional duties, devoted himself assiduously to the study, under its natural conditions, of the varied life—both of men and animals—with which he was brought in contact, he has much to tell that is thoroughly worth reading. The life of a forest officer in those days was particularly favourable for studies of this kind, and the fact that the means of locomotion were then more primitive than at present, gave him far more opportunities for gaining a thorough knowledge of the country than are possessed by those who use the modern facilities for rapid transit.

Mr. Webber's story has to do with two different regions, the first including the Himalayan and sub-Himalayan forests of Kumaon and the Nepalese borders; the second embracing parts of Bandelkhand and the Central Provinces, with the Nerbada valley between. The first naturally presents the greater attraction on the score of variety, for Mr. Webber's picturesque descriptions take us from the hot and reeking jungles at the foot of the range, through the regions of the *Pinus longifolia* ("chir") and *excelsa*, of silver fir and spruce, to the great snowy peaks and the Tibetan district of Hundes, to which he made his way across the snowy passes. This alpine region was then naturally much less known than it is now, and Colonel Smyth, with whom Mr. Webber made his trip into Tibet, had only recently selected, from the Bhotia schools under his inspectorship, the first of the native explorers who were soon to add so much to our knowledge. Mr. Webber

draws many fascinating pictures of the life and scenery of these regions, especially vivid being his descriptions of the tiger-haunted jungles at the foot of the hills, with their teeming bird-life; of the great "chir" forest, with its heat and wearisome monotony; and of the wide Tibetan plains, with their crude colouring, thin air, and remarkable sunsets. The section dealing with the Central Indian forests on the Pachmari and Seoni plateaus is hardly inferior in interest, and a particularly graphic description is given of a hunt by wild dogs of which the author was witness. Much interesting information is given throughout on the primitive forest tribes with which the author was brought in contact. Occasionally, perhaps, we are tempted to think that some slight liberties have been taken with the grouping of the pictures, as when the scarlet blossoms of the leafless cotton trees are introduced among the features of a *June* landscape. We may regret, also, that more attention is not paid to the life-conditions of vegetation in the different regions, for it is only occasionally, as at p. 232, where the various contrivances which secure the trees against overthrow by the Indian storms are described, that this subject is touched upon. A series of pictures illustrating the different types of forest would have been a valuable addition to the book. The botanical nomenclature is not always quite up to date; thus the generic name *Picea* is still applied to the silver fir, while Roxburgh's names for the cotton tree and the "saj" are retained.

Taken as a whole, however, the book is a welcome addition to the literature on India, for whereas systematic treatises on the geography, statistics, and natural history of the country are numerous, the art of picturesque description of its natural features has, as is so often the case, been practised by but few. A word of praise must be given to Mr. Webber's sensible remarks on the subject of sport, for while a keen sportsman himself in the best sense of the term, he has nothing but reprobation for the indiscriminate butchery practised by so many, which he likens, with some justice, to the slaughter of pigs—at so many the hour—at a Chicago bacon factory. His observations on the neglect of forestry in other parts of the British Empire are also very much to the point.

China.

'Through Hidden Shensi.' By Francis H. Nichols. London: Newnes. 1902.

The interest of this book lies principally in the striking picture it presents of the life and character of the dwellers on the great plain of Shensi—the oldest element, apparently, in the population of modern China. The author is an American who went to China to report on the Shansi famine, on behalf of those philanthropic persons in the United States who had raised a fund for the relief of the starving population. He describes his book as "an attempt at a picture of Oldest China and its people as I saw them in their land—sowing, reaping, toiling, thinking, and misjudging the world beyond their mountains as persistently as that world misjudges them." He describes how he approached his task with all the prejudices of the foreigner, and how, when compelled to meet the people on their own level, his interest in them was aroused so that he came in time to see things from their point of view. It is this power of adapting himself to the standpoint of the people of whom he writes which gives the book its value, and which, though it may perhaps occasionally carry the author too far in his favourable judgment of Chinese as opposed to European civilization, should do much to modify too hastily formed views with a contrary tendency. Mr. Nichols considers that much good might result from giving the Chinese "the benefit of the doubt" more often than is done; and the account given of the way in which, during the late troubles, the Shensi people gave their moral support to their mandarin, Tuan Fang, in his

defence of the missionaries—at the risk of his own life—might certainly lead some to reconsider their verdict respecting the Chinese. Food for reflection is also supplied by the description of Sian (Singan-fu), which is said to have "no haunts of crime and human degradation," nor "any rendezvous of gilded vice and dissipation;" and by the remark of an old Mohammedan tea-merchant, who, after expressing his willingness to see the Christians overthrow the idols, added, "the only trouble is, if Sian were a Christian city it would be as bad as Shanghai.'

Mr. Nichols paid a visit to the celebrated Nestorian tablet in Sian, which does not seem to have been seen by any recent travellers, and which stands at present amidst a heap of ruins, protected neither from vandals nor from the elements. Photographs of the monument are given.

Siberia.

'Das russische Kustengebiet in Ostasien.' (Primorskaja Oblastj) Von C. von Zepelin. Berlin: Mittler & Son. 1902.

The fact that so much of the existing literature on Eastern Siberia is in Russian gives a value, beyond that which attaches to most compilations, to this concise summary of our knowledge about that region. A sketch is given of its history and surface features, but the bulk of the work is devoted rather to the economic aspects of the country. The writer has a high opinion of the resources of the Eastern Coast region, though he allows that their development will be a matter of time. The political position of Russia in the Pacific is, he thinks, assured by the opening of the Siberian railway.

AFRICA.

North and East Africa.

'Travel and Sport in Africa' By A. E. Pease. 3 vols London: Humphreys 1902

On viewing the imposing form and sumptuous get-up of these volumes, it is impossible to avoid regret that the amount of solid scientific matter contained in them can hardly claim to be commensurate with the outside appearance. A large proportion of the volumes is taken up with sporting or other incidents of travel, and while the former will no doubt appeal to a certain class of readers, serious students will be tempted to wish that the solid material had been more carefully sifted out for their use from the general mass. Many of the illustrations with which the work is so lavishly provided are instructive, and some (particularly in the case of the photogravures) are of real merit, though the same can hardly be said of many of the text illustrations. Still, even in its more trivial side, the work has a value from the picture it presents of the state of the countries traversed when the recent advance of European influence was only just beginning, while a particularly pleasing feature is the author's sympathetic attitude towards the native races, and his evident desire to further the good repute of his country among them.

The arrangement of the work is chronological, the author's various expeditions being described in the order in which they were undertaken, which involves some amount of see-saw between different parts of the continent. The bulk of vol. i. treats of journeys in Algeria, during which the interesting Aures group of mountains was visited. The rest of the volume and the first part of vol. ii. takes us to Somaliland, this section opening with a general account of the people, their country, and its animal and vegetable productions. Mr. Pease's routes in Somaliland led through some little-known country, and this part of the work possesses, perhaps, the greatest original value. The latter part of vol. ii. brings us to the

Algerian Sahara, where the oases of Ghardaya, Gerrara, and Wargla were visited, and as recent literature on this région is almost entirely French, the views and impressions of an English traveller are of considerable value. Vol. iii. deals with Abyssinia, into which, however, the author and his party did not penetrate further than Adis Ababa and Lake Zwai. Mr. Pease was struck by the absence of all appearance of a town at the capital, the native huts being widely scattered over the valley. He is evidently by no means so enthusiastic an admirer of the Abyssinians as some recent travellers. In each section of the work lists of animals, birds, and plants are given, but with respect to the last, it is to be regretted that in few cases have botanical determinations been possible. Short historical summaries are here and there inserted, and will no doubt be of use to the general reader. The maps, prepared at Stanford's establishment, deserve a special word of praise.

Italy and Abyssinia.

'The Campaign of Adowa and the Rise of Menelik.' By G. F. H. Berkeley. Westminster: Constable. 1902.

It may seem at first sight that the interest in the events which finally freed Abyssinia from the threats of an Italian protectorate is hardly fresh enough to warrant the publication of an English narrative of the campaign, now become a matter of history merely. The lessons of the campaign are, however, not without importance for the future, owing to the undoubted influence on the fate of the surrounding European territories, which the rise of a powerful military empire under Menelik must exercise, whether or no the anticipations will be realized of those who see in the Abyssinian empire a source of danger to her European neighbours. Mr. Berkeley's account of the campaign embodies a large amount of material which has not been generally available to English readers, both with respect to the actual campaign and the events which led up to it, and may be recommended as a trustworthy guide to those who wish to gain a comprehensive view of the events described.

Egypt.

'Egypt painted and described by R. Talbot Kelly.' London: A. & C. Black. 1902.

Mr. Kelly's pleasantly written descriptions of Egyptian life and scenery will bring the general characteristics of the country before the minds of stay-at-home readers with peculiar vividness. But it is the thoroughly artistic coloured illustrations which are the special attraction in the book, and which will probably be somewhat of the nature of a revelation to those not familiar with the scenes themselves. So much of the charm of Eastern scenery depends on the colouring that photographs, however excellent, can convey but a slight idea of the reality. Vivid as are the colours employed by the artist, they are so harmoniously blended that harsh and startling effects are altogether avoided. Much as he is inclined to regret the modern vulgarization of things Egyptian, which seems to have brought a subtle change over the spirit of the scene, Mr. Kelly is enthusiastic in his praises of the natural beauties which remain, and of the interest attaching to a study of native life where comparatively uncontaminated by the new influences. The pictures of Nile and desert scenery, in their ever-changing aspects, are drawn with particular vividness, but the author's descriptions all manifest the true feeling of the artist, and among the many charming sketches, that of the changing aspects of nature on the banks of one of the smaller and more secluded canals, is perhaps as attractive as any. More practical questions are now and then touched upon, and the remarks on such subjects as the recent experiments at

tree-planting, no less than those relating to the general condition of the people, will be read with much interest.

AMERICA.

Alaska.

'Harriman Alaska Expedition.' 2 vols. New York: Doubleday, Page & Co.; London: John Murray. 1901.

These two handsome volumes afford an argument of great force upon the question of "how to spend a summer vacation." While it is true that few of us are millionaires, able to pick up a party of enthusiastic scientific men to work either for us or themselves, we can all spend the time of relaxation, when it comes, in useful, profitable work. Not all expeditions which have been merely backed by money have been successful; something more is needed which money cannot buy outright, particularly in another line of work, and that is organization and direction. Granted all these conditions fulfilled, and there is still another rock upon which many parties have split—namely, lack of harmony. The Harriman expedition seems to have had all the above conditions reasonably well met, and, considering the size of the company, this was somewhat remarkable. If this example, on such a scale, could only induce the ordinary mortal in a smaller way to have some "hobby" of his own which he could develop in his leisure time, it is perfectly certain that there would be more satisfaction and less "ennui" in the life of the everyday man. The volumes are also an evidence of how much can be compressed into a comparatively short time. Two months were occupied by the trip after leaving Seattle, and although some six hundred species new to science were secured, it is safe to say that the resources of Alaska have not been by any means exhausted. This party of trained specialists possessed an unsurpassed equipment and a vessel with a sufficient working force, which enabled them to avoid the delays so common and so annoying in ordinary work of this sort.

The illustrations of the volumes are of very high artistic as well as scientific value, though it is a pity that space should be taken by repeating illustrations when such a tremendous wealth (five thousand negatives) was at hand to be drawn upon. As a book of travel, it contains much less of rubbish and more of value than is usually the case. The first volume is taken up with three distinct papers, in addition to the account of the organization of the expedition. The narrative of the trip is provided by John Burroughs, who is fortunate in his style, and he is to be congratulated on avoiding the "diary" method, so tiresome in most travellers' books. One feels that he must have expressed the sentiments of the whole party when he closes with the remarks, "No voyagers were ever more fortunate than we. . . . We had gone far and fared well." In the next paper upon the Pacific coast glaciers, we have an all-too-short account of these interesting ice-masses. John Muir should have given us more than sixteen pages upon this subject, in which he is a most eminent authority. The volume closes with an account of the natives of the Alaska coast region by Geo. B. Grinnell, the editor of *Forest and Stream*.

The second volume is devoted to the history, geography, and resources of Alaska. Discovery and exploration, by Dall; birds, by Keeler; forests, by Fernow; geography, by Gannet; atmosphere, by Brewer; our newest volcano, by Merriam; the salmon industry, by Grinnell; fox-farming, by Washburn; while Dall breaks into song at the end of the book. The illustrations of the birds by Fuertes are particularly fine. These papers are only such as would appeal to the interest of the general public. The technical papers, of which twenty-two have already

appeared in the *Proceedings of the Washington Academy of Science*, will be brought together later in a series of technical reports which will fill several volumes. They will cover the fields of geology, palæontology, zoology, and botany: they should make a valuable contribution to science, and give a well-earned reward to time, money, and energy well expended.

WILLIAM LIBBEY.

COLOMBIA.

'Nueva Geografía de Colombia.' Por F. G. Vergara y Velasco. Tomo I. Geografía General, Bogotá. 1902.

This royal 8vo, of about 1100 closely printed pages, although claiming to be only a geography, treats extensively of the physical features of Colombia, productions of the soil, geology, mineral wealth, commerce, history, ornithology, fauna, flora, ethnology, and geography of the neighbouring states of Venezuela, Ecuador, and Brazil. It is extensively illustrated with locally engraved views and small page maps which are interesting and valuable. Its usefulness is somewhat impaired for want of proper classification of the immense quantity of useful data it contains, while the small type, poor paper, and crowded pages make its study difficult. The labour of collecting its varied information must have been prodigious, and the author merits the highest praise for his industry and perseverance in a task which must have required interminable patience, more especially in a land where knowledge of value is hard to acquire, and frequently almost impossible to verify. Aside from this, probably the obstacles to the printing of such a volume at Bogota, in the midst of one of the most sanguinary civil wars Colombia has known, must have been formidable; but, with the scantiest means, it has been published, "for account of the Government, in the printing office of the *Boletin Militar*." The aid thus extended to the author speaks well for the intelligence of the rulers of the state, and if it can produce such an important work under such great disadvantages, we may hope that, when peace again smiles on that land of marvellous resources, we may find Señor Vergara's facile and intelligent pen entrusted by the Government with the task of dividing his great 'Geography' into several volumes.

G. E. C.

PACIFIC.

MARSHALL ISLANDS.

'Die Stabkarten der Marshall-Insulaner.' By A. Schück. Hamburg: H. O. Persiehl. 1902. Fcap, 37 pp. and 11 pls.

With characteristic German thoroughness, and after much correspondence with museum curators all over the world, Herr A. Schück, of Hamburg, has studied all the materials he could gather concerning the stick-charts of the Marshall islanders. It has long been known that these skilful navigators construct frameworks of thin sticks of wood or strips of bamboo to serve as charts. Some of the sticks constitute the frame, while the others indicate the directions of the currents, together with the tracks to be taken by the canoes when sailing from one atoll to another in the group. At appropriate relative spots are fastened small shells, stones, seeds, or even knots of thin string to represent the atolls or islands. When the skeleton charts are held in an appropriate direction, which at night can be determined by the pole-star, the mariners know in which direction to steer in order to fetch the island for which they are making. Some of the charts are employed to instruct the lads in the geography of this island group; others are charts that include the

Ratak and Ralik chains of islands in the Marshall group; others, again, are confined to the Ralik chain, while some take in only the southernmost islands. A von Chamisso first discovered a map at Guam about 1817, which related to Ulea, in the Caroline group, but no further inquiries appear to have been made. In 1862 an American missionary, Dr. L. H. Gulick, who resided in Ebon, gave a short but very good account of these charts, which was published in a missionary paper and in the *Nautical Magazine*, vol. 31, p. 304. The first specimen appears to have been brought to Europe by Consul F. Hernsheim, who published an account of it in his 'Beitrag zur Sprache der Marshall-Inseln,' 1880, p. 88. Since then several descriptions have been published. This careful study by Herr Schück is illustrated by seven plates, containing figures of forty-seven stick-charts, and one plate of Marshall island canoes. The remaining three plates are from material supplied by Dr. A. C. Haddon, which demonstrates that although the Papuans of Torres straits do not make sailing-maps, yet they have a fair idea of the geographical features of this district, which they can depict with intelligence. The islands at which a culture-hero stopped, on his way to Murray island from the west, are recorded by stones in a sacred spot, the meaning of which is taught to the lads when they are initiated. Herr Schück has published a paper entitled "Die nautischen und astronomischen Kenntnisse der Bewohner der Karolineninseln" (*Aus allen Weltteilen*, 1882), for which he was specially qualified by his experience as a practical mariner; but he is known mainly for his laborious work in calculating, mapping, and discussing magnetical observations.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Geomorphology.

'Wissenschaftliche Charakteristik und Terminologie der Bodengestalten der Erdoberflache.' Von August Neuber. Vienna and Leipzig: W. Braumüller. 1901.

This bulky volume, which is the outcome of twenty years' study on the part of the author, is largely polemical in character. Field-marshal von Neuber, who occupies a high place as a military topographer, has long been convinced of the unsatisfactory character of existing terminology respecting the forms of surface of the globe, and this opinion has been strengthened rather than diminished by the publication of Baron von Richthofen's 'Führer für Forschungsreisende,' and Prof. Penck's 'Morphologie der Erdoberfläche,' in which those writers put forward their respective schemes of classification of the morphological features of the Earth. He is inclined to lay the blame on the insufficient knowledge possessed by most geographers of the science of topography, on which he has already published a volume, and which, he holds, can only be properly understood by those who have themselves had a thorough practical training in the representation of the surface features on maps. In the present volume he gives a detailed review of the forms, both of water and land, on the surface of the globe, frequently criticizing the views of his predecessors, and setting forth his own ideas as to the most rational scheme of classification. The greatest objection to the book, from a practical point of view, is the difficulty of arriving at any notion of the general principles on which the author proceeds in his task, for he begins at once with the detail of his subject, and it is only with regard to individual features that we are able, without wading through the six hundred odd closely printed pages, to learn the grounds on which he is at issue with generally accepted methods.

OCEANOGRAPHY.

In Indian Seas.

'A Naturalist in Indian Seas.' By A. Alcock, M.B., F.R.S. London: Murray. 1902.

In this book we have a most fascinating and complete popular account of the deep-sea fauna of the Indian seas. The book is one of intense interest throughout to the zoologist, but at the same time its matter is arranged in such a form that no special knowledge is required from its readers. The natural history of the forms is dealt with in a broad spirit, and the author has not hesitated to indicate how the structure of the various animals is, in his opinion, especially adapted to their physical environments. Scientific accuracy has been everywhere retained, while the matter is fully explained both in the text and by a most admirable series of illustrations.

On the geographical side brief indications are given of many considerations of the greatest importance, which the author, to our regret, has, in spite of his great experience, not pursued. Foremost among these is the question of the connection of the Indian and Atlantic oceans in the Tertiary period, in reference to which many instances are given of animals common to both seas. The author, indeed, gives internal evidence that he has considered this question deeply, but, failing to see the great general interest of the subject, has not cared to treat the question in a book which professedly deals with natural history alone.

The Indian seas are divided into three parts: the Laccadive sea, the Bay of Bengal, and the Andaman sea. Of these, the first two are open to the ocean to the south, and hence, in their fauna, are of no particular interest. Their bottom temperatures gradually decrease down to 35° Fahr. at about 1800 fathoms, but the greater part of the Laccadive sea lies within the 1200-fathom line. The Andaman sea, on the other hand, is an enclosed sea, attaining a depth of upwards of 1700 fathoms, and a temperature of about 41° Fahr. at 800 fathoms, below which there is practically no further decrease. There would, then, seem to be of necessity a ridge of less than 800 fathoms in depth, preventing a free circulation of water between the greater depths of the ocean and the Andaman sea. This is shown to be the case by soundings of 736 fathoms between the Andaman and Nicobar islands, and of 760 between the latter and Sumatra, while the Malacca strait does not attain a greater depth than 100 fathoms. The Andaman sea, then, would seem to be the most northern of that series of deep and enclosed basins which separate the East Indies into two lines, and of which the Bali-Flores and Banda seas have lately been shown by the Siboga Expedition to be examples.

A good picture is given, in the course of the work, of the bottom of the Bay of Bengal, but the deposits are very lightly treated of. The presence of a continuous bed of "greensand" within and between the Laccadive islands from about 700 to 1100 fathoms is not without interest. The land deposits extend out from 60 to 300 miles from the Indian coasts, and 100 miles to the west of Middle Andaman island, fragments of rude earthen pottery and numerous decomposing leaves were dredged from 1644 fathoms. The richest ground for the zoologist was found between 200 and 1000 fathoms, not too far from the shore; but the whole work of the *Investigator*, the survey ship of the Indian Marine, indicates enormous economic possibilities for well-equipped steam-trawlers operating down to the lesser depth.

Among the more isolated islands, Dr. Alcock landed on and has a few remarks to make about the Cocos, South Sentinel (a coral reef raised a few feet above high-water mark), and some of the Laccadives. *All* the latter are considered to be the remains of eroded atolls; but the author's meaning is not clear, and he has evidently not considered the submerged banks of the group. Considerable banks of pumice

are not uncommon features of the islands of the Maldive group and Pacific Ocean, as well as of the Laccadives. Minikoi is scarcely the paradise which it has been depicted, though the people always put their best side foremost. The land is equally divided between the government and the people. The latter's half has eroded away so rapidly that it is probably not the third of its former size, while the government portion has grown. The former part is completely tilled, while the "crown lands" are absolutely uncultivated and going to waste. The young men are sent away to provide the rice which is necessary for their families' maintenance. Considering the available land, the population is denser than that of any part of India. And, finally, the state of continual anxiety in which the people of Minikoi live is far more fatal to them than the storm-waves that once in a century decimate the population.

J. STANLEY GARDINER.

CARTOGRAPHY.

MAP PROJECTIONS.

'Maps: their Uses and Construction. A short popular treatise on the advantages and defects of maps on various projections, followed by an outline of the principles involved in their construction.' By G. James Morrison, M.I.C.E., F.R.G.S. Second Edition, revised and enlarged. London: E. Stanford. 1902.

The first edition of Mr. Morrison's little work on map projections was reviewed in the *Geographical Journal* for November, 1901, and it is satisfactory to find that, in accordance with suggestions there made, a great deal has been done in this second edition towards rendering it more generally useful and complete.

The first chapter remains much as it was before. The second has been revised, and a description of an elliptical projection (Mollweide's) added. The third chapter has been considerably enlarged and rearranged, among the important improvements being more complete descriptions of the Stereographic and Mercator's projections. The account of the conical projection has also been expanded. Chapter iv., dealing with projections of small areas, has been entirely re-written. By the introduction of various tables, Mr. Morrison has further improved his work, although some of these, such as that of meridional parts, are somewhat too short and incomplete to be of great practical value. This second edition is a decided advance upon the first, and in its present form the work constitutes a useful little introductory handbook to the subject of map projections. The author does not pretend that it is more than this, and those who desire to go more fully into the matter should consult the writings of Germain, Clarke and others.

MAP-DRAWING.

'Memory Map-drawing.' By a Professional Teacher. (R. G. Scanlan, Pialba State School, Queensland.) Halifax: Blatchford Brothers. 1902. Pp. 28.

The suggested memory-aids in the form of guide-lines and pictures may be of use to some teachers who may not have the time to evolve a system of the kind for themselves. A more valuable feature is the attention given to the projection of maps, which is entirely neglected by too many teachers, but which, with the aid of the tables supplied by the author, is quite within the reach of intelligent children. Memory map-drawing is no doubt valuable as supplying a basis of topographical knowledge on which to build further study, but care is necessary lest too much attention be given to it at the expense of other branches of geographical teaching.

GENERAL.

The History of Geography.

'The Discoveries of the Northmen in America, with Special Relation to their Early Cartographical Representation.' By Joseph Fischer, S.J. Translated from the German by Basil H. Soulsby, B.A. London: Henry Stevens. 1903.

The German original of this important work has already been reviewed in the *Journal* (vol. xix. p. 746), and it is therefore unnecessary to enter into details respecting its general scope. Both the translator and publishers deserve the thanks of English readers for their promptness in putting into their hands the results of Prof. Fischer's investigations, the interest of which is not confined to the more special subjects treated of in the present work, but is perhaps derived still more from the light incidentally thrown on the wider field of the geographical revival of the fifteenth and sixteenth centuries. In this connection a few points not touched upon in our former notice through considerations of space may be here alluded to. Prof. Fischer's greatest achievement in the field of historical geography is, of course, his discovery of Waldseemüller's splendid maps of 1507 and 1516, and pending the eagerly expected publication of facsimiles of these, the reproduction in the present work of one of the sheets of the former (with its inset of the world according to Ptolemy), gives some idea of the style of the maps, some account of which is also contained in the text. But an almost equally important contribution is the light thrown on the life-history and geographical work of Donnus Nicolaus Germanus, hitherto known erroneously as Nicolaus Donis,* the editor of several editions of Ptolemy, including the famous Ulm editions of 1482 and 1486. To Prof. Fischer has been due the discovery (made, like that of the Waldseemüller maps, at the Wolfegg library) of a unique manuscript copy of one of Donnus Nicolaus' editions, which he has proved conclusively to have served as the prototype of the Ulm editions. The world-map contained in this manuscript is reproduced in the present work, together with other maps by Donnus Nicolaus. The important influence exercised by this cartographer on the geographical knowledge of his day is shown by the fact that his first edition of Ptolemy, of which manuscripts exist at Modena and Paris, is held by Prof. Fischer to have been the prototype of the Rome editions of 1478 and 1490, while maps of the well-known Canerio or Cantino type are attributable to his second edition, preserved in manuscript at Warsaw and the Vatican.

The style in which the work is produced fully sustains the reputation of former publications by Mr. Stevens's firm, and its moderate price (8s.) will make it widely available. An excellent index, not given in the German edition, has been added, together with a few extra bibliographical references. The only drawback is the absence of subject headlines (supplied in the German edition), which do much to facilitate reference.

THE MONTHLY RECORD.

EUROPE.

Underground Water-supply of the Home Counties.—A pamphlet furnished by the Underground Water Preservation Association brings to notice

* Donnus being the equivalent of the Italian Dom, the designation of a lay brother.

a question of extensive interest to geographers, and especially to geologists, while at the same time seeking to demonstrate an economic abuse of the gravest nature. Certain daily and other journals have recently given light to the fact of the serious depreciation of wells, springs, and the headwaters of streams in the high-lying lands which surround the London basin; along the line of the Chilterns, in Berks, Bucks, and Hertfordshire; in Essex; and in the Kentish uplands. In these parts for some years past, wells and springs which furnish the local water-supply to villages and farms have been found to diminish or wholly fail of their supply in a way unprecedented as far as memory or history serves, and unaccountable on the score of deficiency of rainfall or any natural cause. This fact (which has come under the notice of the writer of this paragraph in the case of the Beane, the Mimram, and other feeders of the Lea) the Association sets out to explain as a result of the injudicious taxing of the subterranean water-supply in the chalk by certain of the water companies supplying London. The work of the Association originated in Kent, and thence enlarged its scope. The pamphlet sets forth its objects: to prevent the abstraction of water by companies to the detriment of local interests; to suggest the best means of preserving the local supply in any special case, and the best position for companies' pumping stations with this end in view; and to prevent companies from obtaining Parliamentary powers of which the exercise would be detrimental. The history of the formation of the Association, its distinguished patronage, and its work up to the present are set forth, together with expert reports on the whole question, press extracts, and an account of a deputation to the Right Hon. W. H. Long on the subject, while copious appendices give lists of members and guarantors, also rainfall tables from Greenwich and stations within the affected areas. No sentence shows in a clearer light the deep importance of the question, than that which instances the removal of country families to the metropolis owing solely to the shortage of water in their homes.

The Pyrenees and the Distribution of Animals.—A paper on the influence of the Pyrenees on animal distribution was read by Dr. R. F. Scharff, of Dublin, at the Berlin Meeting of the International Congress of Zoologists in 1901, and has since been issued as a reprint from the proceedings of that body. After pointing out that ranges which run from east to west like the Pyrenees have a greater influence on animal distribution than others, owing to the fact that they stand in the way of northward or southward movement resulting from climatic changes, and noting that identical species on the two sides of the range may either have taken a circuitous route round its ends or crossed the crest when it was lower or subject to a still milder climate than at present, Dr. Scharff instances the present distribution of certain forms as indicating the probable routes of former migrations. In the case of animals like the chamois, which he considers to have crossed the Pyrenees from the east and spread over the Cantabrian mountains within comparatively recent times, there is, of course, nothing surprising in the fact that the range has proved no barrier, but it is otherwise with some of the instances given from among the reptiles and still lower groups. Many western forms of these have, however, crossed into France, in some cases, no doubt, by the lower hills at the extremities of the chain, while eastern forms have also made their way into Spain. The most striking instances are, perhaps, those of similar migrations by amphibia, whose movements are subject to many difficulties. Among the salamanders, *Molge marmorata* and *M. palmata* seem to have been limited within comparatively recent times to Spain and France respectively, but each has now crossed the range, though in small numbers. These seem to have utilized the lower western spurs as a point of crossing; but an older form (*Salamandra*

maculosa) has evidently crossed the crest of the range, and was found by Dr. Scharff at an altitude of 1800 metres (5900 feet), on the pass of "Le Somport." The distribution of *Molge aspera* is interesting as favouring the view of a former connection between the Pyrenees and the mountains of Corsica and Sardinia, possibly in Mesozoic times. Dr. Scharff arrives at the general conclusion that, though causing some hindrance to animal migration, the Pyrenees can be easily turned at their two extremities, and that the older forms have, as a rule, crossed the crest of the range, probably, in most cases, before the glacial epoch.

The Kaiser Wilhelm Canal.—The report on the traffic of the Kaiser Wilhelm canal, recently issued by the German Government, gives the statistics for the year ending March 31 last. No great development in the traffic has taken place. While in the previous year the total number of vessels of all sorts using the canal was 29,045, of an aggregate tonnage of 4,282,094 tons, that of the year ending in March last was 30,161, and the tonnage 4,285,301. It appears that there was a decrease of tonnage in British, German, Belgian, French, Norwegian, and Swedish vessels, but an increase in Danish, Dutch, and Russian. The total receipts of the canal amounted to £106,351, and the expenses to £121,141, a decrease having taken place in both.

Commercial Education in Austria.—We extract the following from a recent publication of the Ministry of Education in Vienna, dealing with the distribution of commercial schools in Austria. The organization of these schools has been in the hands of the state since 1888. At the present date (end of 1902) there are in existence 186 schools in 117 different localities; 23 higher commercial schools (*Akademien*, etc.), and amongst these 44 composite schools. Most of these are private schools, a small proportion of which are endowed by the state, while a very few are Government institutions. The importance of Vienna as the commercial capital of the country is recognized by its supply of 18 schools, of which 2 are "higher" and 12 composite. Prague, as centre of the chief industrial and commercial crown lands of the western half of the kingdom, has 18 commercial schools, of which 2 are higher, and 1 composite. The relatively large number of schools in Bohemia is due to the rivalry of the two languages—German and Czech. Bohemia possesses 83 schools in 54 towns, forty five per cent. of the total for the whole of Austria, chiefly congregated in the north-west. Next comes Moravia with 28 schools in 17 towns, and then Lower Austria with 26 schools in 9 towns; Styria has only 10 schools, distributed in 7 towns. Bukowina, the most easterly, and Dalmatia, the most southerly, of the crown lands, have only one school each. The great preponderance of the German element in commercial affairs appears from the fact that German is spoken in 122, or sixty-six per cent. of the schools. In 48 schools (twenty-six per cent.) the Czech language is employed. Both languages are used in the teaching in 10 schools. Four schools, of which three are "higher" (in South Tyrol, Trieste, and Cattaro), use the Italian language. Polish is spoken in the academies of Lemberg and Cracow. The relatively large proportion of non-German academies (18 out of 23) shows how uniform is the effort to provide adequate educational training for each of the great linguistic divisions of the people.

Professorial Appointment in Vienna.—Dr. Eugen Oberhummer, professor in the University of Munich, has been appointed to the chair of historical geography in the University of Vienna, vacant by the death of Prof. Tomaschek. Dr. Oberhummer was born in Munich in 1859, and has made journeys in the Nearer East, publishing an important memoir on Cyprus. He is regarded as a special authority on the geography of ancient Greece, and has recently interested himself in the history of cartography, especially of the Alps.

Emigration from Southern Italy.—A recent official report draws attention to the extraordinary depopulation now going on in the province of Basilicata. With a population of about half a million persons, most of whom are engaged in agriculture of a most primitive kind, it covers an area of about 3000 square miles. It is ravaged by malaria, and vast districts of it have been confiscated by the state for non-payment of taxes. The forests have been largely destroyed, but the rivers, which might be utilized for irrigation, have hitherto been left untapped. It is stated that more than half the arable land is in the hands of the state, which means that it has reverted to the condition of prairie. In the first three months of 1902 no less than 22,000 emigrants left the provinces.

The Over-population of Poland.—The population of Poland, according to a recent report of our Consul-General at Warsaw, is as much as 192 to the square mile—a density not only greater than that of any other province of the Russian empire, but even more than that of the neighbouring Prussian provinces and of France. The holdings of the peasants are so small that it is almost impossible for them to make a living by agriculture. While in the United Kingdom 17 per cent. of the population look for a living in the fields, in Germany 40 per cent., and in France 47, 66 per cent. are tillers of the soil in Poland, and the wage average is only 9*d.* per diem. High rents prevent peasant ownership, and of the total rural population of 9,000,000 there are 850,000 males of the peasant population who have no land at all, and some 660,000 more whose land will not keep them. The production of corn is continually becoming less and less sufficient for the support of the population, and extensive emigration accordingly takes place.

ASIA.

Lake Baikal.—The exploration of Lake Baikal by M. F. K. Drizhenko was commenced in 1896, and a note on the first year's preliminary investigation was published in the *Journal*, vol. xi. p. 144. Since then M. Drizhenko has visited the lake every year with a party of assistants, and has made detailed surveys of the shores, determined several positions astronomically, and executed triangulation and plane-table surveys, besides magnetic and temperature observations. The longitude of Listvenichnoye was ascertained to be 2′ 17″·4 east of Irkutsk, with a probable error of ±0″·04, and nine points in all were determined by astronomical observation. In examining the southern shore east of Utulik, a submarine ridge over 5 miles long at a depth of 8 fathoms was discovered, where fishing-boats can anchor and set their nets. The Maloye More, between Olkhon and the western shore, is 46 miles long by 9 broad, and is an excellent refuge for boats during storms, and the Olkhon gate is easily navigable. To the north of the Maloye More the western shore offers few facilities for anchorage, the water being deep and the bays exposed. On the eastern shore the bottom slopes more gradually, and there are several good harbours. Among these are the Davsha and Sosnovka bays, and the Chivirku gulf with a depth of 300 fathoms at the mouth, gradually shallowing to 10 feet and less at the upper end. The last has several bays inaccessible to steamers owing to shallows at the entrances, but the Bezimannaya is convenient and sheltered. The Barguzin bay is shallow, and the water is rough when the wind is south-west. Further south to the Bezimannaya bay, the coast is dangerous. This bay is sheltered, and has good anchoring-ground, whereas the Gorachinskaya is exposed, and anchors drag there. Boats put in because of the proximity of the mineral springs in the Turka valley. Several parts of the coast had not been thoroughly examined at the end of 1901, to which period M. Drizhenko's report in the *Izvestiya*, No. 2, 1902, extends. The soundings in the middle and southern

parts of the lake were incomplete, and the survey of the delta of the Selenga, etc. An examination of the Upper Angara valley is also desirable, with a view to the construction of a road to the Vitim. At present goods for the Vitim goldfields are conveyed from the railway at Tuiret to Zhigalovo (265 miles), and thence at high water in the spring and autumn 700 miles down the Lena and 200 miles up the Vitim to Bodaibo, whereas by Lake Baikal the distances would be 330 miles on the lake, 150 miles on the upper Angara to the mouth of the river Ohuro, and thence by land 130 miles to Bodaibo, or a total distance of not much more than 600 miles. Not only would the distance be shorter, but the traffic would be independent of the level of the rivers, the time of transit shorter, and the cost half or a third what it now is. The following publications are to be issued: a general map of the lake on the scale of 12 miles to an inch; maps of the northern, middle, and southern sections on the scale of 2 miles to an inch, of which the first two are already issued; an atlas of sections on the scale of about 2 miles to 3 inches, showing the coastal strip with anchorages, etc.; and a sailing directory. Several lighthouses have been erected.

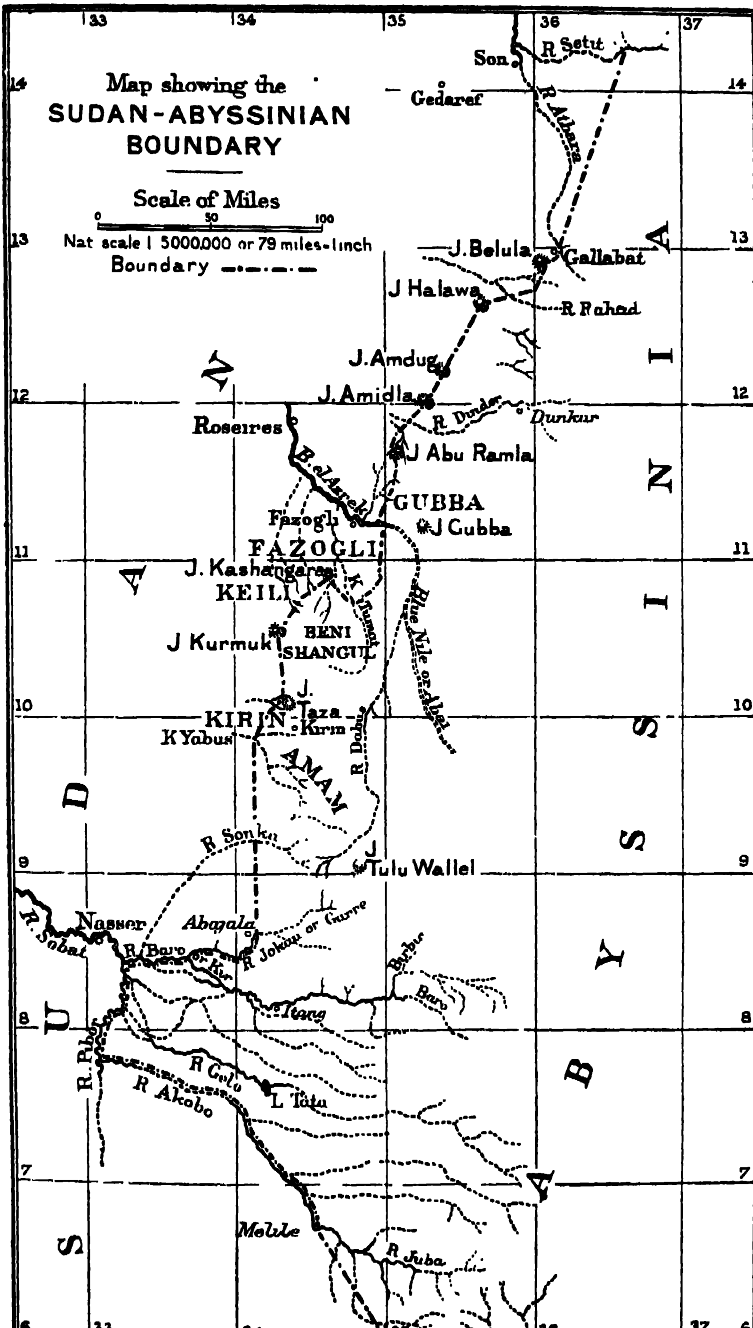
AFRICA.

Jebel Garra and the Kurkur Oasis.—From the Survey Department of the Public Works Ministry of Egypt there has been issued (Cairo, 1902) a pamphlet on the results, topographical and geological, of a recent survey of this little-known district in the neighbourhood of Assuan. The Nile is here flanked by the dreary sand-covered plains of the Nubian sandstone, undulating and very gently rising from the river-level. Journeying across these plains, in a direction west by south of Assuan, Dr. John Ball, who headed the reconnaissance and has written the pamphlet, reached cretaceous rocks and the typical low, flat-topped hills of the cretaceous region, after a journey of some 20 miles. He had previously used points of the triangulation in the survey of the First Cataract, from which Jebel Garra was visible, to locate the position of that hill, and he furnishes the results of his observations here, and of those on which they were grounded. Jebel Garra is situated about halfway between Assuan and Kurkur oasis, and Dr. Ball's route-survey was made with the plane-table and measuring-wheel, checked by his triangulation points. Whereas in most previous desert explorations the Egyptian Geological Survey has had to rely on the barometer for the determination of levels, in this case Dr. Ball was able to fix the levels of main points trigonometrically. The height of the highest point of Jebel Garra and of the azimuth station on a hill near Kurkur were also trigonometrically determined. After a short general description of the topography of the Assuan region, the author passes to a more detailed description of the route. The scenery at and about Jebel Garra is striking in the extreme. The limestone is faced and split in every direction; the path of the ascent follows fissures of great depth, but only a few yards wide, and the whole mass is described as apparently "tumbling to pieces," while the effects of the erosion of wind-borne sand afford a wonderful illustration of this destructive force. The wide view from the summit over the Libyan desert is also notable. The route as it approaches the oasis is less well marked than it has been previously over the plain. The first view of the oasis is described as most pleasing after the tedium of the desert track, a statement borne out by some admirable photographic reproductions, the views contrasting very strikingly with the hard bareness of Jebel Garra, detailed plates of which are also given. There are two shallow pools or "wells" in the oasis, upon which a number of desert tracks converge; the water-supply appears to be constant, as the demands of Dr. Ball's party were immediately replaced. The oasis, however, is not inhabited, nor is it of sufficient extent

to maintain any permanent settlement. The observations of Dr. Ball's reconnaissance, while mainly geological, include very full data in other departments; indeed, it is remarkable how much was achieved in a bare week's work. Thus the temperature of the water at the oasis is given as 15° C. (59° F.) when the air was 16¼° C. (61·7° F.). A few meteorological observations are given, and Dr. Ball was favoured with a very heavy thunderstorm accompanied by striking phenomena, and has also remarks to offer on the mirage. The geology, both of the region generally and of the route traversed, is discussed at length, as also the origin of the water-supply of the oasis, which the author leaves an open question, inclining to the view that it is derived solely from rain-water. Besides the beautiful reproduction of photographs, the pamphlet is illustrated by large maps of the route and the region concerned, and of Kurkur itself, the reproduction of which is an admirable illustration of the efficiency of the Egyptian Survey Department.

The Sudan-Abyssinian Frontier.—The opposite sketch-map shows the line taken by this frontier, as defined by the agreement of May 15, 1902, the text of which was not made public till December last. It will be seen that the boundary thus fixed is the western frontier of Abyssinia only, that on the south being still undetermined. By this agreement Abyssinia obtains access to the Pibor-Sobat, from the mouth of the Akobo to that of the Baro, although the extreme claims made by Menelik in this direction have not been conceded. Further north, between the Baro and Blue Nile, the new frontier runs for the most part well to the west of the 35th meridian, taken as the dividing line between the British and Italian spheres in the agreement of 1891, though the Blue Nile itself is struck close to that meridian, some 15 miles above Fort Famaka in the Fazokli district. North of the Blue Nile the line does not diverge very materially from the old frontier of the Egyptian Sudan as shown on most maps previous to the Mahdist revolt, though this was never laid down with any precision. But here too, in places, the alteration is to the benefit of Abyssinia. In the south the frontier is formed by the course of the Akobo as far as Melile on that river, and thence runs in a straight line to the intersection of 6° N. with 35° E. Among the other provisions of the treaty, the Emperor Menelik engages not to construct, or allow to be constructed, any work across the Blue Nile, Lake Tsana, or the Sobat, which would arrest the flow of their waters into the Nile, except in agreement with His Britannic Majesty's Government and the Government of the Sudan; to lease to those governments, as a commercial station, a block of territory near Itang, on the Baro, having a river frontage of not more than 2000 metres, and an area not exceeding 400 hectares; and to allow the construction, through Abyssinian territory, of a railway to connect the Sudan with Uganda. For a better understanding of the nature of the country through which the new frontier runs, we may refer to the papers and maps by Majors Austin and Gwynn in the *Journal* for May and December, 1901, and June, 1902. An annex to the treaty also defines the mutual frontiers, north and east of Khor um Hagar on the Setit, of the Sudan and Eritrea on the one hand, and Eritrea and Abyssinia on the other, the result being somewhat to modify previous arrangements. Thus the wedge of territory, running south-west to the Atbara, which was assigned to Eritrea by the preliminary settlement of April, 1901, is now cut off, while, on the other hand, Eritrea gains somewhat at the expense of Abyssinia between Khor um Hagar and the Mareb. These frontiers are not shown on the official map on which our sketch is based.

Hydrography of the Bahr-el-Ghazal Region.—An instructive sketch of the hydrographical system of the Bahr-el-Ghazal and its affluents has been given in the *Annales de Géographie* (vol. xi., 1902, pp. 315–338, and reprint) by Lieut.



Map showing the
SUDAN-ABYSSINIAN
BOUNDARY
Scale of Miles
0
50
100
Nat scale 1 5000,000 or 79 miles-1inch
Boundary
SUDAN
ABYSSINIA
Son
R Setit
Gedaref
R Atbara
J. Belula
Gallabat
J Halawa
R Rahad
J. Amdug
J. Amidla
R Dinder
Dunkur
Roseires
J Abu Ramla
GUBBA
J Gubba
Fazogli
FAZOGLI
J. Kashangaro
KEILI
K Tumat
Blue Nile or Abai
J Kurmuk
BENI SHANGUL
J. Taza
KIRIN
Kirin
K Yabus
AMAM
R Dabus
R Sonka
J Tulu Wallel
Nasser
R Sobat
Abajala
R Jokau or Garre
R Baro
Barbur
Baro
Itang
R Pibor
R Gelo
L Tata
R Akobo
Melile
R Juba
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35
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37
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6

A. H. Dyé, one of the members of the Marchand Expedition, whose astronomical determinations of positions during that expedition have already been referred to in the *Journal* (vol. xix. p. 505). The broad features of the system have, of course, been long known, but the bewildering character of the swamps which occupy its lower portion has made it particularly difficult to lay down the courses of the streams, and it was only the necessity for a thorough survey for their navigation by the steam-launch *Faidherbe* that led to the more thorough elucidation of the system, at the cost of infinite labour, by the Marchand Mission. After describing the ferruginous laterite plateau which occupies the whole southern part of the Bahr-el-Ghazal province as well as adjoining parts on the Congo basin, Lieut. Dyé sketches the transition from this region, in which the streams flow in steep-sided valleys, to the sea of swamps which lies along the ninth parallel. It is in about 7° 20′ N. that the first change occurs, the river-banks opening out and leaving between them an alluvial flood-plain, grassy and intersected by swamps, through which the river winds in a tortuous course, much choked by sandbanks. At the height of the rains this is entirely flooded. Still lower the rocky valley-sides entirely disappear, and the clayey banks sink below the mean water-level, the rivers becoming more and more narrow, and diminishing in depth until they are finally lost, each in its own belt of swamp, which forms a sea of grass, *um suf*, and papyrus. The course of the Swe, the largest tributary of the Bahr-el-Ghazal, through the western extremity of these swamps was laid down with much exactness, but in the case of other streams, the Bahr-el-Homr, Bahr-el-Arab, Tonj, and Rohl, Lieut. Dyé is able only to indicate the general lie of the swamps which mask their lower course. The Bahr-el-Ghazal itself, from Meshra-er-Rek downwards, was carefully surveyed, and many indications were found of the changes which have taken place since the days of its early explorers, though M. Dyé considers the sketch given by Lejean in 1862 as wonderfully correct in its general outlines. He divides the drainage channel (for such, rather than a true river, is the character of the Bahr-el-Ghazal) into three sections, each with its particular characteristics, flowing respectively north, north-east, and east. The first is at times of a great width, as at the expansion known as Lake Ambaja, or Ambatch lake (wrongly Ambady on some English maps). There is much floating vegetation, and the channels frequently change with the winds. The depth is nowhere greater than 13 feet in this section, which is characterized as the region of lakes, lagoons, and reed-beds. In the second section, characterized by the growth of papyrus, the channel becomes much narrower, and reaches depths of 20 feet and more, though the figures given by the former travellers seem somewhat exaggerated. The width becomes greater again in the last section, the banks of which are, as a rule, marked by anthills covered with brushwood. Schweinfurth was mistaken in saying that the current of the Bahr-el-Ghazal is imperceptible, for, except in expansions and side branches, some movement can always be traced, and in the narrowest section it reaches a speed of 1¼ miles an hour. A remarkable characteristic of the region is the small variation of water-level between the seasons, owing to the impounding of the water in the marshes. The maximum flood-level occurs on the Bahr-el-Ghazal in November and December, or two months later than on the Swe, and various facts are quoted showing the slight effect which a rise on the upper courses of the streams has on the water-level of the swamp region.

Reorganization of French West Africa.—A change in the organization of French West Africa has once more been brought about by the decree of October 1 last. With a view to the consolidation of the territories under the supreme jurisdiction of a single functionary, the office of governor-general has been

separated from that of governor of the Senegal colony, this, like the other Colonies of French Guinea, the Ivory Coast and Dahome, being now placed under a lieut.-governor, so that the governor-general can now devote his whole attention to the furtherance of the wider interests of the territories. At the same time, his headquarters are removed from Saint Louis to Dakar, to still further emphasize his independence of the purely local affairs. Another important change has been introduced into the territorial subdivision of French West Africa, the districts on the upper Senegal and Niger which were detached from the French Sudan by the decree of October, 1899, being once more united with the "military territories" of the middle Niger and southern Sahara into an administrative entity to be called the "Territories of Senegambia and the Niger." These territories will in future be administered by special functionaries, under the supervision of the governor-general.

AMERICA.

Mr. Hanbury's Expedition in Northern Canada.— We referred, in the *Journal* for December last (p. 655) to Mr. David Hanbury's latest expedition to the arctic regions of Canada, giving some account of his preparations during the winter spent on the coast of Hudson bay for his advance to the north during the early part of 1902. Mr. Hanbury has since returned from a successful journey, during which he carried out the main items of the programme he had sketched beforehand. A portion of his route was across entirely unexplored country, but, as Mr. Hanbury remarks in a note describing his journey, there are so few marked geographical features in the barren North Land of Canada that his map will merely show a dotted line following up a small river across lakes and over the divide, and then descending a similar river to the Arctic ocean. From Te-be-elik lake the route, which was surveyed by sextant and prismatic compass, led across to near Pelly lake on Back's river and thence to the Arctic coast a little to the east of Ogden bay. Following this coast westwards, Mr. Hanbury found that the previous survey had been very correct. In traversing Kent peninsula he found that this was almost an island, being nearly cut off by a long inlet from Warrender bay, which had not been seen by the surveyors of Melville sound, as the entrance is very narrow. A fresh-water lake 3 miles long almost completes the waterway. Ascending the Coppermine about 80 miles, the party struck west across the divide separating that river from Great Bear lake. Failure of food-supplies made it necessary to hurry, and, the route being also not easy, an accurate survey was here impossible. There is one portage of 8 miles, and many shorter ones. The Dismal lakes of some maps are really only one piece of water, the whole length of which Mr. Hanbury traversed. Besides the route-survey, he took constant observations for latitude, and brought home entomological, botanical, and geological collections, which will be worked up by specialists.

The Leeward Islands.—The census for the Leeward islands was taken throughout the colony on March 31, 1901, and is now given in the recent Colonial Office report. The total population was 127,434, and was distributed as follows: Antigua, including Barbuda and Redonda, 34,971; St. Kitts-Nevis, with Anguilla, 46,446; Dominica, 28,894; Montserrat, 12,215; and the Virgin islands, 4908. The only islands in which a decrease of population occurs are Antigua, St. Kitts, and Nevis, all of which have sugar as their main export. These had their population reduced by 1941, 1094, and 313 respectively; but as the other islands increased, there was a net decrease of only 289 in the total population during the last decade. The large excess of females over males (13,733) may be taken as an indication of the emigration of men who have left the islands in search of

employment elsewhere. The meteorological records show that the last year's rainfall was unusually heavy. Thus in Antigua the total average fall was 57·6 inches, which exceeded the mean of the last twenty years by 11·5 inches. In St. Kitts it was 61·1 as against 38 inches during the previous year, and on November 2 and 3 as much as 22 inches fell in the two days on some of the mountain estates. In Dominica the mean rainfall was 65·71 at the United States station. On the Middleham estate, however, 239·5 inches fell, and at several other stations falls of over 100 inches were recorded.

Abnormal Weather Conditions in Curaçoa.—Judging from the recently published report of the British consul at Curaçoa, the island seems to have experienced considerable variation from the normal meteorological conditions during 1901. Though in the region of steady and constant easterly Trades, the winds blew often and for long periods from unusual quarters. While neither the mean atmospheric pressure (29·81 inches) nor the mean temperature of the air (81·1° Fahr.) varied materially from the average, the rains were very unusually protracted during the latter half of the year, exceeding all previous records. The total rainfall for the year was 25·13 inches against an average of about 16 inches, and in consequence the island showed an unusual verdure, and was provided with abundant fruits and vegetables throughout what is ordinarily the dry season. Thunderstorms were of frequent occurrence, numbering thirty-four, or nearly six times as many as those of the two preceding years combined. The variable winds alluded to prevailed from August to December, and were in every case accompanied by close and sultry weather. The coldest month was January, with an average of 78·6° Fahr., and the warmest September, with 83°·0.

POLAR REGIONS.

Baron Toll's Expedition.—News of this expedition received in Europe during last autumn is recorded in Nos. 10 and 11 of *Petermanns Mitteilungen* for last year. During the spring of 1902 the leader had left the ship with the astronomer Seeberg, in order to make his way to the little-known Bennett Land, the zoologist Birula having already set out for New Siberia island. The *Zarya* sailed on July 1, but, owing to unfavourable ice-conditions, was unable to reach either of these islands, so that the explorers could not be brought off before the winter set in. The *Zarya* took up winter quarters at the mouth of the Lena, and it was proposed to despatch a sledge expedition for the rescue of Baron Toll and his associates during January. There seems no special cause for anxiety on their behalf, as Baron Toll had, before setting out, had in view the possibility that he might be forced to winter on Bennett Land.

Captain Warneck in the Arctic Ocean.—In a pamphlet published by order of the Russian Admiralty, Captain Warneck gives an account of the voyage of the *Pakhtusof* in 1901. The sea was crossed two or three times between Novaya Zemlya and the mainland. On July 25, after a delay of a day or two owing to the ice, the western mouth of the Matochkin Shar was reached, and on August 20 the channel was found to be unusually free of ice. The Shar is 220 miles long by 2 to 8 miles broad, and winds among cliffs sometimes rising precipitously to 5000 feet, while behind rise summits of undetermined height, and glaciers descend to the water. On the Kara coast the water was open and ice had not been seen, according to information received by Captain Warneck, since the beginning of May. The vessel was therefore able to proceed northwards to the Medvezhi (Bear) gulf, in 74° 8′ N. lat., which is 120 miles long. It was entered in 1897 by Mr. H. J. Pearson in the yacht *Laura* (see Colonel Feilden's paper in vol. xi. p. 363), and had been recently visited by the artist Borisof and his assistant, T. E. Timofeyef, who

named the glacier at its head the Witte glacier. The Witte ends in a huge wall more than 3 miles broad and rising 57 feet above the water, and not far from it a depth of 36 fathoms was sounded, so that the thickness of the ice at the extremity is about 273 feet. Bergs were calved with great frequency, and one of them, aground in 510 feet of water, rose 39 feet above the surface. On August 9 the *Pakhtusof* was stopped by ice as it was steaming eastward along the Russian coast at a distance of 60 miles from Medinski point. This experience is important relatively to the project that has been put forth for a port on the Khaipudirska bay, and a railway thence to the Ob. In another pamphlet, reprinted from the *Izvestiya*, vol. xxxviii. No. 3, Captain Warneck deals with the distribution of ice in these seas with especial reference to navigation. The sea is open earlier to the north than the south of Kolguyef island. The Kara strait was open on August 2, and on August 27 the Matochkin Shar was clear throughout its whole length; while the Yugor strait was closed till September 2, and its navigability is very dependent on meteorological conditions. In view of the difficulties often encountered in the straits, Captain Warneck considers that the route round the north of Novaya Zemlya is worth a trial. At the end of August, the pack-ice recedes from the north coast of Novaya Zemlya, leaving the sea open up to lat. about 80°. To ascertain the conditions in the Kara sea, a vessel of the ice-breaker type should round the north of Novaya Zemlya, cross to Cape Mate-Sale, return by the Matochkin Shar to the Arctic, re-enter the Kara sea by the Kara strait, and, having attained the coast of Yalmal near the Sharanof islets, cross once more to the Yugor strait.

The Spitsbergen Degree Measurement.—The Swedish Expedition which went last summer to Spitsbergen to complete the operations for the measurement of an arc of the meridian, left unfinished the preceding year owing to unfavourable weather conditions, returned during the autumn after successfully accomplishing its task, a junction being effected with the Russian net of triangles in the more southern parts of the group. The operations were begun in 1898, and had, therefore, occupied in all no less than five summers.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Figure of the Earth.—A mathematical paper, of first importance to geodesists, on "The Vibrations and Stability of a Gravitating Planet," by Mr. J. H. Jeans, Fellow of Trinity College, Cambridge, was communicated to the meeting of the Royal Society on December 4, by Prof. G. H. Darwin. An abstract appears in the new number of the *Proceedings*. It is pointed out that "in the classical investigation of the displacements produced in a gravitating sphere by given surface forces, the most important of the gravitational terms is omitted. The effect of this omission is to necessitate a correction, and this may entirely invalidate the solution when we are dealing with spheres the size of the Earth or other planets. In fact, it appears that for a gravitating solid of the kind we are discussing, the spherical configuration may be one of *unstable equilibrium*." Applying the conclusions arrived at to questions connected with the figure of the Earth, Mr. Jean says, "It seems to be almost certain that the present elastic constants of the Earth are such that a state of spherical symmetry would be one of stable equilibrium. On the other hand, if we look backwards through the history of our planet, we probably come to a time when the rigidity was so small that the stable configuration of equilibrium would be unsymmetrical. At this time the Earth would be pear-shaped, and the transition to the present spherical form would take place through a series of ruptures. It is suggested that the Earth, in spite of this series of ruptures, still retains traces of a pear-shaped configuration. Such a

configuration would possess a single axis of symmetry, and this, it is suggested, is an axis which meets the Earth's surface somewhere in the neighbourhood of England (or possibly some hundreds of miles to the south-west of England). Starting from England, we find that England is at the centre of a hemisphere which is practically all land; this would be the blunt end of our pear. Bounding the hemisphere we have a great circle, of which England is the pole, and it is over this circle that earthquakes and volcanoes are of most frequent occurrence. Now, if we suppose our pear contracting to a spherical shape, we notice that it would probably be in the neighbourhood of its equator that the changes in curvature and the relative displacements would be greatest, and hence we should expect to find earthquakes and volcanoes in greatest numbers near to this circle. Passing still further from England, we come to a great region of deep seas—the Pacific, South Atlantic, and Indian oceans; these may mark the place where the 'waist' of the pear occurred. Lastly, we come, almost at the antipodes of England, to the Australian continent; this may mark the remains of the stalk end of the pear." Although Mr. Jean's description of the distribution of land and sea, and of regions of seismic and volcanic disturbance, may be open to some criticism by geographers and geologists, it need not seriously affect his general results, which throw a new light on an extremely obscure problem.

Rate of Torrential Erosion.—Prof. Chaix, of Geneva, suggests that the well-marked and different characteristics of torrential and glacial erosion may be traced in many Alpine valleys, and the limit between them determined. He has examined the valley of the Drance de Bagnes, which flows into the Rhône at Martigny, from this point of view, and finds that torrential erosion accounts for only some 6 to 22 metres of excavation since glacial activity ceased. He concludes that we overestimate the rate of torrential erosion, and that the immense volume of matter worn away in pre-glacial valleys must have taken much longer than is generally supposed. This is an important argument in favour of the glacial theory of hanging valleys of Penck and others. May not the facts be also interpreted as an indication of the shortness of the period of post-glacial erosion?

The Atlantis Problem.—Dr. Scharff read a paper at the Zoological Section of the British Association at Belfast, in which he stated the results of his studies of the fauna of the eastern Atlantic islands. He considers that Madeira and the Azores are the remains of an ancient Tertiary land, attached to Europe, and probably severed from it in Miocene times, again united, and not finally disconnected until the Pleistocene period. Any land bridge across the Atlantic must have been farther south, uniting North Africa with Brazil and Guiana in early Tertiary times, and probably disappearing beneath the waves, except for a few peaks, in the Miocene period.

Limiting Width of Meander Belts.—Prof. Mark Jefferson has been investigating the width of the belt containing meanders of a river, and finds it bears a fairly constant ratio to the width of the stream itself. To measure the width of the meander belt, the maximum distance between lines tangential to the outer swings of the river is determined. It is found that streams rarely attain their maximum meanders until the belt is two or three times as wide as the successive loops are distant along the general course of the river; and, further, that the meander belt is about eighteen times the width of the stream itself, as long as it flows across a flood-plain, but that the ratio increases greatly (to over thirty in the cases examined by Prof. Jefferson) where the meanders are incised. On the Dniester the ratios of 14·3 and 16·4 were obtained where it flowed over a flood-plain, but they rose to 34 and 36 where the meanders were incised in higher ground. The average difference of the flood-plain ratios is only 3·3 from the mean,

whereas in the case of incised meanders it is 12·3. The cut-offs which regulate the width on the plain cannot readily occur where the stream-bed is cut in the rocks (*National Geographic Magazine*, October, 1902).

A Cause of River-curves.—Dr. Callaway points out, in the *Geological Magazine* for October, 1902, that most tributaries enter meandering rivers on the convex side of their curves. This he explains as due to the component movement of the united waters of main stream and tributary being directed towards the bank opposite the mouth of the tributary, but a little lower down, and there "the lateral force will be balanced by the resistance of the bank, and the carrying power of the current will be reduced. . . . The growth of this new land will cause a deflection of the current, which will impinge upon the opposite bank lower down, and will begin to excavate." Above the new land the main stream will be barred, and in the slack water sediment will be thrown down. The problem is one of the many related to the morphology of riverine forms which demand immediate investigation, and might most profitably be studied in the field during our vacations.

Soundings in the Atlantic.—The November number of the *Annalen der Hydrographie* contains two valuable papers on new soundings in the Atlantic ocean. Captain A. Simonsen, of the Hamburg and South American Co.'s ss. *Tijuca*, reports on soundings off the east coast of South America, some of which show considerable differences from those given on the charts. The charts give in most cases depths not exceeding 50 fathoms, while a number of Captain Simonsen's soundings in the same area did not touch bottom at over 100 fathoms. Most of the discrepancies occur between 20° 50′ and 21° 30′ S. lat., and 40° to 40° 20′ W. long. The other and longer list reports on the sounding expedition of the cable ship *von Podbielski* in the summer of 1902. Three hundred and eighteen new soundings are given, along three lines: (1) mouth of the English channel to the Azores; (2) Azores to New York; (3) New York to Azores. Special care was taken, by the use of Rendle's sounding-tube and the Lucas "snapper," to obtain good samples of the bottom, and observations of surface and bottom temperature were made, the latter with a "Reynolds" deep-sea thermometer, concerning the construction of which the Deutsche Seewarte asks for information.

List of Soundings.—We have received the Admiralty list of soundings and temperature observations received from H.M. surveying ships, Indian Marine Survey, and British Submarine Telegraph Companies during 1901. The list includes eleven series, two in the South Indian ocean, one in the North Indian ocean, one in the Red sea, one in the North Atlantic, three in the South Atlantic, one in the North Pacific, and two in the South Pacific.

Natural History Collecting.—We draw the attention of intending travellers to the excellent little handbook of instructions for collectors lately issued by the Natural History Museum at South Kensington. It gives in a clear and concise form hints on the collection and preservation of specimens, both of the various subdivisions of the animal kingdom, and of plants, fossils, and minerals. Each section (which may also be had separately) has been prepared by a member of the staff of the Natural History Museum, which, it is hoped, may in course of time benefit in one way or another by the collections of those who use it. While intended primarily for the use of voluntary collectors, it is equally suitable for use by more professional naturalists. While most of the sections have been specially written for the purpose, Mr. G. Murray reprints, with few additions, the directions for collecting and preserving plants drawn up by Robert Brown, considering that any fresh directions "could only fail to equal these in conciseness and lucidity." It may be observed, however, that some of the directions do not tally with those of

other guides, and show that doctors may disagree on these as on other subjects. Thus, the tin collecting-boxes, pressing-boards, and straps, which are so strongly condemned in the instructions issued by the authorities of the Calcutta Herbarium, all find a place in the recommendations with regard to outfit. The different conditions in tropical and temperate regions no doubt account for the discrepancy. As a whole, the instructions are a decided advance on any yet issued, and their comprehensiveness is shown by the fact that, as regards the animal kingdom, they deal with every grade of life from tigers to mosquitos.

OBITUARY.

Sir Arthur Hodgson.

We regret to announce the death of Sir Arthur Hodgson, K.C.M.G., a Fellow of the Society of old standing, and an ex-member of the Council. Sir Arthur was the son of the Rev. Edward Hodgson. He was born in 1818, and was educated at Eton and Corpus Christi College, Cambridge. After serving as a midshipman in the navy for three years, he determined, at the age of twenty-two, to try his fortune in the colonies, and settled down at Darling Downs, in the Moreton Bay settlement, which then formed part of New South Wales. Here he speedily became one of the leading colonists. He was made a member of the Legislative Assembly of the colony, and played an active part in public affairs. In 1856 he was appointed general superintendent of the Australian Agricultural Company. Three years later the settlement was separated from New South Wales, and the colony of Queensland came into existence. Mr. Hodgson was quite out of sympathy with the movements which were so rapidly changing the old order of things in Australia, and had strenuously opposed the separation. But once the change had been effected, he threw himself vigorously into the public life of the new colony. For some years he represented Warrego in the Legislative Assembly. In 1862 he acted as commissioner for Queensland at the great International Exhibition in London, and in 1867 filled the same post at the Paris Exhibition. A year later he became Secretary of Public Works for the colony, while the year after that saw him Colonial Secretary. Five years later he came home and settled down at Clopton House, Stratford-on-Avon. He devoted much time and attention to the affairs of that ancient borough and of the county of Warwick, both of which he served in many distinguished capacities. He still retained, however, his interest in the affairs of Queensland. In 1874, the year of his return, he represented the colony at the Vienna Exhibition. When, four years later, he occupied a similar position at the Paris Exhibition, occasion was taken to confer upon him the Companionship of the Order of St. Michael and St. George. His promotion to be a Knight Commander followed in 1886, when he was a Royal Commissioner for the Colonial and Indian Exhibition, and general secretary for the reception committee. Sir Arthur Hodgson became a Fellow of the Society in 1856, and served on the Council in 1892–93. His death, at the advanced age of eighty-four years, occurred on Christmas Eve.

James Cornwell, Ph.D.

By the death of Dr. Cornwell, which took place on December 12, the Society loses a Fellow who in his day did much to improve geographical education in the primary and secondary schools in this country. Dr. Cornwell had reached the

advanced age of ninety years, and his name is not now so familiar in the educational world as it was about the middle of last century. With the multiplication of modern text-books, his manuals, which embraced a variety of school subjects, have lost much of their popularity; but they may justly be said to have served a useful purpose, at a time when the methods of teaching in vogue in public schools admitted of still greater reform than at the present day, and that they were appreciated by those for whom they were intended is testified by the extraordinary success they enjoyed. Dr. Cornwell was himself a teacher, and possessed great natural qualifications for his calling. He had the born teacher's happy knack of imparting his knowledge to others, his views on education were broad, and he has just claim to be regarded as one of those who heralded in the age of modern reform in this department of national life. In 1846 his abilities were recognized by his being appointed the first principal of the reconstituted Borough Road Training College, Isleworth, then newly placed under Government control, and now the leading training college for primary teachers in this country. Here he rendered valuable service to the cause of elementary education for ten years, at the end of which period he retired, and devoted himself entirely to the writing and constant revision of educational text-books. In the geographical field his labours resulted in the production of a 'School Geography,' a 'Geography for Beginners,' and a 'School Atlas.' Of these the first is the best known; it was very popular in secondary schools, and ran into ninety editions. Dr. Cornwell became a Fellow of the Society in 1860.

Julien Adrien Hilaire Louis.

We regret to announce the sudden death, on December 15, of Mr. Julien Adrien Hilaire Louis, a Fellow of this Society and a barrister of the Middle Temple. Mr. Louis, who was in his sixty-fourth year, was born in Lyons on March 6, 1839. He was, notwithstanding the French name, the son of a Polish officer of the period of the "Emigration." The greater part of his life was spent in India, where he resided almost continuously from 1856 to 1895. He served as a volunteer during the Mutiny in 1857. Later, in 1865, he received the formal thanks of the Government of Bengal for the measures he adopted for the relief of a local famine—measures which resulted in the saving of many lives. A pamphlet which he wrote upon the condition and prospects of Serici culture in Bengal suggested the steps which were afterwards taken by the Government for the revival of the silk industry in India. His interest in the ancient literature of the country was evidenced in his membership of the Buddhist Text Society of India. He was also the author of a work entitled 'The Gates of Thibet,' which was the fruit of travel in Independent Sikkhim, British Bhootan, and the Dooars.

CORRESPONDENCE.

Captain Dickson's Map of the Kenya and Kitui Districts.

The age of geographical pioneering being almost past, has not the time come for a more critical use of hill-shading, especially in original maps issued by geographical societies? The question is suggested by the map of part of the Kenya and Kitui districts from a plane-table sketch by Captain B. Dickson, which was published in the January number of the *Geographical Journal.*

On my journey to Mount Kenya, in 1899, I traversed all the western portion of the region depicted, and can therefore speak with regard to it from personal knowledge. I should have been quite prepared to find that my observations for distance and direction needed some amendment when compared with a district survey, for mine was a mere route survey, disturbed at certain points by bad weather and hostile natives. I was surprised, however, to obtain in the hill-shading of Captain Dickson's map only a very confused image of the salient features of the district, which are, in reality, beautifully simple and markedly contrasted.

To commence with a small point in the south, I note that the Nairobi has a continuous valley indicated both above and below its falls. Now, I can prove by photographs taken by my colleague Mr. Hausberg, that immediately above the falls the Nairobi is practically flush with the plain, and that it tumbles over a precipice into the head of a gorge. Moreover, a few miles to west there is a well-marked escarpment facing eastward, which is breached by the Nairobi emerging from an upper gorge. None of these features, which are essential to the understanding of the country, are indicated, and, on the contrary, that which does not exist is suggested.

Further northward the shading pre-supposes the existence of a high ridge, some 15 miles in length, to which the names of Kamahua and Boinzero are applied. This ridge has a great abrupt descent eastward towards the Tana, but, as it is shown, it should also have a very considerable and almost precipitous fall towards the plateau extending from it westward. In other words, it should, even from the west, be a feature of the landscape almost as important as Donye Sabuk. This is very far from being the case. Whether seen from the plains west of Donye Sabuk, or down the valleys which come from Meruka (Muluka), or from the hill of Kandundu in the north, whose position is indicated by the figures "4000" to the right of the word "Mbirri," it has the appearance of a mere rise on the edge of the tableland. I notice that in Captain Dickson's map it is marked with the height of 5160 feet. The plateau to west of it cannot be many hundred feet lower. I base this statement on a line of rough observations which I took on the spot. The elevation of the gap between the mountains Kanjuyu and Kanbicho is given by Captain Dickson at 3800 feet, and was estimated by me at 3900, and I have, therefore, confidence in the general truth of my measurements.

But the shading becomes still more disappointing a little further to northward. The view from Kandundu in every direction except the north-west is a striking one. To south-west is a plateau which is lower than the tableland between Boinzero and Meruka rising behind it. This lower plateau is ridged repeatedly from west to east, owing to the relatively advanced denudation of the lava-sheet. Eastward it ends suddenly in an escarpment which, starting from Kandundu, runs southward and then south-eastward in the direction of the peaked Ithanga hills. This escarpment is repeatedly breached by the tributaries of the Tana emerging from the valleys of the plateau. There are some small foothills (quite subordinate, however, to the escarpment itself), and from these the plain extends eastward to the Tana and beyond to the horizon. The only features of the wide expanse seen from Kandundu eastward are some distant insular hills and the long belts of trees which indicate the courses of the Tana, the Marathwa (Mathioya), and the Maragua. In the map under discussion I find no intelligible suggestion of the great contrasts of this landscape.

Turning now to the northward view from Kandundu, I again find confused detail where the features are, in fact, clear and emphatic. Kanbicho (Kambijo) and Kanjuyu (Kamuti) are two isolated gneissic hills rising from 700 to 900 feet

above the plains. Their long axes are directed in a south-easterly direction parallel to one another. The gap between them is cut right down to the level of the Meranga plain, and the Tana, already a much more important stream than is suggested by the map, flows in a shallow trench past the northern foot of both hills. The Marathwa flows past their southern foot at a level about 150 feet lower than the Meranga plain. There is a second gap to westward of Kanjuyu. So marked is the isolation of these two hills, Kanbicho and Kanjuyu, that they constitute a very striking landmark when seen from the distant shoulders of Mount Kenya.

Northward of the Tana spreads the plain of Meranga, traversed only by some low rises. Immediately north of Kanjuyu is shown in the map the confluence of the Tana and its tributary, the Ragati. They meet in a hippopotamus pool, into which they fall over lava cliffs. Above these falls they are flowing almost flush with the plain, and yet the hill-shading suggests gorges of an importance equivalent to that of the Athi. The result is entirely to break the effect of the *plain* of Meranga.

Finally, I observe the inscription curving round Meranga from north-west to north-east—"Hills gradually rising towards Kenya." Now, Kenya lies to northward and north-eastward, and the ascent north-westward is to the plateau of Laikipia, whose level edge is a conspicuous feature as seen from the northern foot of Kanbicho. The plain of Meranga ends some 7 or 8 miles north-westward of Kanbicho at the foot of a definite and considerable escarpment, which curves northward and north-eastward from the neighbourhood of Katuri. This escarpment is cleft at two points by the Sagana and Ragati, whose valleys trench the plateau of which the escarpment is the edge. Some distance behind commences the final ascent to Laikipia. All these facts are patent from Kanbicho.

I do not wish in any way to blame Captain Dickson. His short article indicates that he has appreciated far more of the essential contrasts than are shown upon his map. It is quite likely that the chief fault lies with the draughtsman. The practice of filling in the outlines of a survey with hill-shading—"according to taste," as the cookery books say—is only too frequent. The result in the present case has been to produce a map misleading for the traveller because its parts are disproportionate and ungrouped, and puzzling to the teacher and scientific geographer because its crowded details are to a large extent meaningless. Is it too much to expect that geographical surveyors and map-makers should have mastered at least the outlines of the science of land-forms? The artist who depicts the human form finds it necessary to know so much of anatomy as is needed to explain the contours of the body.

H. J. MACKINDER.

[Captain Dickson's map is the result of a plane-table survey; he was not able to survey in equal detail all parts of the region covered by the map. He submitted to the Society a blue-print copy of his original drawing. The map published by the Society is simply a copy of the blue print on a smaller scale; the drawing was supervised and a proof was carefully revised by Captain Dickson, certain alterations in the course of rivers being adopted by him at the suggestion of Mr. S. L. Hinde. The intention of hill-shading and the necessity for discrimination in its use are quite realized in the map-drawing department of the Society; but in the case of Captain Dickson's map the draughtsman was simply a copyist. Of Captain Dickson's competency as a surveyor there can be no question, nor indeed of his skill as a cartographer. He served with Colonel Sir Thomas Holdich on the staff of the survey expedition last year in connection with the Argentine-

Chile Boundary Arbitration; and he again accompanies Sir Thomas Holdich this year to lay down the boundary decided upon. Captain Dickson will therefore be unable to reply to Mr. Mackinder's strictures for some time.—Ed. *G.J.*]

The Crozets.

In connection with Prof. von Drygalski's narrative of the voyage of the *Gauss* from Cape Town to Kerguelen (*Geographical Journal*, *ante*, pp. 39–42), it may be of interest to repeat here some of the facts known concerning the flora of the Crozets, especially as he was under the impression that "no human foot had ever before trod this solitary strand."

Although the *Challenger* Expedition equally with Sir James Ross's failed to effect a landing on this group, I brought together all that I could find relating to the vegetation in the 'Botany of the Challenger Expedition' (i. part 2, pp. 207–210), in order to compare it with that of Prince Edward, Kerguelen, and Macdonald groups. Eight species of plants were then known to inhabit Possession island, six of which were collected by the officers of the United States ship *Monangahela*, and two by Captain J. N. East, of H.M.S. *Comus*, who examined the Crozets in 1880 in order to ascertain if any shipwrecked persons were there. The eight plants are—*Pringlea antiscorbutica* (Cruciferæ); *Acæna adscendens* (Rosaceæ); *Azorella Selago* (Umbelliferæ); *Galium antarcticum* (Rubiaceæ); *Cotula plumosa* (Compositæ); *Lomaria alpina* and *Asplenium obtusatum* (Filices); and *Andræa marginata?* a moss. These plants are all widely spread in the highest southern latitudes of phanerogamic vegetation, extending both to the South American and New Zealand outlying islands, or to one or the other of these regions, except *Pringlea antiscorbutica*, which has only been found in Marion, Possession, Kerguelen, and Heard islands.

Captain East reported to the secretary of the Admiralty that the "Kerguelen cabbage" was abundant on Possession island, and also a plant called "red-root," on which, the pilot who had spent some years in the islands assured him, human beings could not only exist, but get fat. Specimens of the two ferns named above, collected by Captain East, are in the Kew Herbarium, where there are also specimens of *Pringlea antiscorbutica* and *Azorella Selago* from Possession island. They were sent alive by Mr. J. M'Gibbon, at that date superintendent of the Botanic Garden, Cape Town, who obtained them through the master of one of the vessels trading to the islands; but as they died on the passage to Kew, they were dried and preserved.

In addition to the eight plants enumerated above, the Americans saw "a small vine with blue flowers," of which, however, they preserved no specimen, and I cannot hazard a guess at what it might be. The sealers in this region informed the officers of the *Challenger* Expedition that rabbits and hogs abounded in the islands, but both were unpalatable because of their food.

W. Botting Hemsley,
Herbarium, Kew.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1902-1903.

Fifth Ordinary Meeting, January 12, 1903.—Sir CLEMENTS MARKHAM, K.C.B., F.R.S., President, in the Chair.

ELECTIONS:—*Hon. Oliver Andrew Borthwick; J. W. Brooke, late 7th Hussars; Ernest Charles Chappell; William Edwards Gray; Arthur Hiorns; Captain E. R. B. Murray, Indian Staff Corps; Charles Partridge, M.A., Assistant-District Commissioner, Southern Nigeria; Lieut.-Colonel George Ripon, Indian Staff Corps; Thomas Alfred May Spargo; Arthur Robert Tudney; Julius Ritter und Edler von Schmaedel.*

The Paper read was:—

"Recent Volcanic Eruptions in the West Indies." By Dr. Tempest Anderson.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. Commerce.
C. Rd = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I = Institute, Institution.
Iz. - Izvestiya.
J. - Journal.
k. u. k. - kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Orography. *B.S.G. Italiana* 3 (1902): 682–716, 757–779, 833–861. **Marinelli.**
Studi orografici nelle Alpi Orientali. Del Socio Prof. Olinto Marinelli. *With Illustrations.*

Alps—Structure. **Wahner.**
Das Sonnwendgebirge im Unterinnthal. Ein typus Alpinen Gebirgsbaues von Dr. Franz Wahner. Herausgegeben mit Unterstützung der Gesellschaft zur Förderung Deutscher Wissenschaft, Kunst und Literatur in Böhmen. Erster Theil. Leipzig and Wien: F. Deuticke, 1903 [1902]. Size 12 × 8½, pp. xii. and 356. *Maps and Illustrations. Price* 35m. *Presented by the Publishers.*
To be reviewed.

Austria-Hungary. *Deutsch. Rundschau G.* 25 (1902): 49–60. **Lukas.**
Studien zur Verkehrsgeographie des österr.-ungar. Okkupationsgebietes. Von Dr. Georg A. Lukas.

Austria-Hungary. *Deutsch. Rundschau G.* 25 (1902): 77-80. ——
Der Streit um das Meerauge in der Hohen Tátra. *With Map.*
Cf. note in the *Journal* for December, 1902 (p. 651).

Balkan Peninsula. *La G., B.S.G. Paris* 6 (1902): 309-312. **Hardy.**
La végétation des pays illyriens. Par Marcel Hardy. *Also separate copy, presented by the Author.*

Carpathians and Alps. *C. Rd.* 135 (1902): 872-874. **Lugeon.**
Analogie entre les Carpathes et les Alpes. Note de Maurice Lugeon.

France. *A Travers le Monde, Tour du Monde* 8 (1902): 393-396. **Combes.**
Le Marquenterre.—Un Coin de Sahara en France. Par Paul Combes. *With Map and Illustrations.*

France—Glaciers. **Kilian and Rabot.**
Commission Française des Glaciers. Rapport sur les variations des glaciers français de 1900 à 1901, présenté à la Commission Française des Glaciers, par W. Kilian. Revue de Glaciologie, par Ch. Rabot. (Extrait de l'Annuaire du Club Alpin Français, 28e volume. 1901.) Macon: Protat Frères, 1902. Size 9 × 6, pp. 92. *Map and Illustrations. Presented by the Commission.*

France—West Coast. *B.S.G. Com. Bordeaux* 28 (1902): 318-357. **Bocquier.**
Les Courants marins des côtes poitevines. Par le Prof. Edmond Bocquier. *With Map.*

Germany. **Hellmann.**
Regenkarte der Provinzen Schleswig-Holstein und Hannover sowie von Oldenburg, Braunschweig, Hamburg, Bremen u. Lübeck. Mit erläuterndem Text und Tabellen. In amtlichem Auftrage bearbeitet von Professor Dr. G. Hellmann. Berlin: Dietrich Reimer (Ernst Vohsen), 1902. Size 10½ × 7, pp. 44. *Map.*

Italy. *B.S.G. Italiana* 3 (1902): 780-798, 878-892. **Errera.**
L'incremento del delta della Toce nell' epoca storica. Nota del Socio dott. Carlo Errera. *With Map.*

Italy. *Riv. G. Italiana* 9 (1902): 521-525. **Magistris.**
Contributi geologici e geografici forniti dalla Direzione dei Lavori della Società Italiana per le Strade Ferrate Meridionali (R.A.). Per L. F. de Magistris.

Italy. **Orsi.**
Das moderne Italien Geschichte der letzten 150 Jahre bis zum Ende des neunzehnten Jahrhunderts. Von Pietro Orsi. Uebersetzt von F. Goetz. Leipzig: B. G. Teubner, 1902. Size 8½ × 5½, pp. x. and 380. *Price* 5.60*m. Presented by the Publisher*

Italy. **Fischer.**
Prof. Teobaldo Fischer. La Penisola Italiana, saggio di corografia scientifica Prima traduzione italiana sopra un testo intieramente rifuso ed ampliato dall' Autore arricchita di Note ed Aggiunte a cura dell' Ing. V. Novaresso, dott F. M. Pasanisi e Prof. F. Bodizza. Torino: Unione Tipografico-Editrice, 1902. Size 11 × 7½, pp. xvi. and 500. *Maps, Diagrams, and Illustrations. Price lire* 14.40. *Presented by the Publishers.*

This is not a mere translation of the German edition published in 1891, but the subject-matter has been entirely revised and extended to twice its bulk.

North-West Europe. **Chisholm.**
Stanford's Compendium of Geography and Travel (New Issue.) Europe. Vol. ii. The North West. By Geo. G. Chisholm. London: E. Stanford, 1902. Size 8 × 5, pp. xxviii. and 742. *Maps and Illustrations. Price* 15*s. Presented by the Publishers.*

Norway-Pilot. ——
Supplement, 1902, relating to the Norway Pilot. Part i. Third Edition (1897). Corrected to June, 1902. London: J. D. Potter, 1902. Size 10 × 6¾, pp. 47. *Price* 9*d. Presented by the Hydrographer. Admiralty.*

Rumania—Geographical Dictionary. **Lahovari and others.**
Marele Dicționar Geografic al Romîniei . . . de George Ioan Lahovari și General C. I. Brătianu, Grigore G. Tocilescu. Vol. v. Podul-peste-Dunăre — Zvorsca. București: J. V. Socecu, 1902. Size 13 × 9½, pp. 810.

Russia. *Zemlevedenie* (1902): 148–164. **Grachef.**
On some lakes of the Kostromsk district. By A. Grachef. [In Russian.] *With Illustrations.*

See note in the Monthly Record.

Russia. *Mém. Comité Géolog.* **20** (No. 2) (1902): pp. 146. **Wosnessensky.**
Hydrogeologische Untersuchungen im Kreise Nowomoskowsk, Gouvernement Jekaterinoslaw. Von W. Wosnessensky. [In Russian, *Résumé* in German.] *With Map.*

Russia—Pechora. **Sergeyeff and Novosiltsoff**
Meteorological Observations made in 1901 at the mouth of the Pechora by the Expedition in the North Glacial Ocean under the command of Captain Sergeyeff and Midshipman Novosiltsoff. [In Russian.] St. Petersburg, 1902. Size 10½ × 7, pp. 100.

Spain. **Williams.**
The Land of the Dons. By Leonard Williams. London: Cassell & Co., Ltd., 1902. Size 10 × 6, pp. xii. and 398. *Portraits and Illustrations. Price 15s. net. Presented by the Publishers.* [Review, p. 63, *ante.*]

Strait of Dover—Currents. **Wilson and Field.**
Report on Observations of the Tidal Currents and Undercurrents in the Strait of Dover, made with a Deep Sea Current Meter. By Maurice F. J. Wilson and Captain A. Mostyn Field, 1900–1901. London: J. D. Potter, 1902. Size 13 × 8¼, pp. 12. *Plan. Price 1s. Presented by the Hydrographic Department, Admiralty.*

Sweden—Lapland. *Tour du Monde* **8** (1902): 529–552. **Launay.**
Au pays des Lapons. Laponie suédoise et Nordland Scandinave. Par L. de Launay. *With Map and Illustrations.*

Switzerland—Simplon *Questions Dipl. et Colon* **14** (1902): 587–609. **Peyralbe.**
France et Simplon. Par E. Peyralbe. *With Map and Diagram.*

Discusses the benefits to be gained by France from the Simplon tunnel.

Switzerland—Simplon Tunnel. *J.S. Arts* **51** (1902): 23–36. **Goegg.**
Le Tunnel du Simplon, et la Nouvelle Ligne de Chemin de Fer Directe Anglo-Italienne pour l'Orient. Par le Dr. Gustave Goegg *With Map and Diagram.*

United Kingdom—Climate. *Quarterly J.R. Meteorolog. S.* **28** (1902): 253–281. **Bayard.**
English Climatology, 1891–1900. By F. C. Bayard. *With Map.*

United Kingdom—Geological Survey. ———
Memoirs of the Geological Survey Summary of Progress of the Geological Survey of the United Kingdom and Museum of Practical Geology for 1901. London: E. Stanford, 1902 Size 10 × 6½, pp. 220. *Price* 1s.

United Kingdom—Lake District. **Brabant.**
The English Lakes. By F. G. Brabant. London: Methuen & Co., 1902. Size 6 × 4, pp. x. and 380. *Maps and Illustrations. Price 4s Presented by the Publishers.* [Review, p. 62, *ante.*]

United Kingdom—Lancashire. **Bailey.**
Mem. and P. Manchester Lit. and Philosoph. S. **47** (1902–1903): (No. 2): 1 10
On the Adventitious Vegetation of the Sandhills of St. Anne's-on-the-Sea, North Lancashire (Vice-County 60). By Charles Bailey *With Plates.*

United Kingdom—London. **Cook.**
Highways and Byways in London. By Mrs. E. T. Cook. London: Macmillan & Co., Ltd., 1902. Size 8 × 5½, pp. xiv and 480. *Illustrations. Price 6s Presented by the Publishers.*

An excellent account of London, its life, institutions, and associations, under the most varied aspects. Mr. Hugh Thomson's illustrations, as usual, are inimitable.

United Kingdom—Meteorology. *Quarterly J.R. Meteorolog. S.* **28** (1902): 229–252. **Mill.**
The Cornish Dust-fall of January, 1902. By Dr. H. R. Mill. *With Diagrams.*

United Kingdom—Scotland. **Hinxman and Wilson.**
Memoirs of the Geological Survey. Scotland. The Geology of Lower Strathspey. (Explanation of Sheet 85.) By L. W. Hinxman and J. S. Grant Wilson, with Petrological Chapter and Notes by J. S. Flett. D.SC., Glasgow. London: E. Stanford, 1902. Size 10 × 6, pp. vi. and 92. *Illustrations. Price* 1s. 6d.

United Kingdom—Scotland. *Scottish G. Mag.* 18 (1902): 577–587. **Privat-Deschanel.**
The Influence of Geography on the Distribution of the Population of Scotland. By M. Paul Privat-Deschanel. (Translated from the French.)

United Kingdom – Scotland. **Dron.**
The Coal-Fields of Scotland. By Robert W. Dron. London, etc.: Blackie & Son, 1902. Size 9 × 5½, pp. 8 and 368. *Maps and Sections. Presented by the Publishers.*

United Kingdom—Scotland—Hebrides. *Nature* 67 (1902): 84 85. **Wharton.**
Local Magnetic Focus in Hebrides. By Sir W. J. L. Wharton, K.C.B., F.R.S. *With Map.*

United Kingdom—Staffordshire. **Gibson and Wedd**
Memoirs of the Geological Survey. England and Wales. The Geology of the Country around Stoke-upon-Trent. (Explanation of Sheet 123.) By Walcot Gibson and C. B. Wedd, with Notes by George Barrow. London: E. Stanford, 1902. Size 10 × 6, pp. 88. *Index-map and Sections. Price 1s. 6d.*

United Kingdom—Wales. **Strahan and Cantrill.**
Memoirs of the Geological Survey. England and Wales. The Geology of the South Wales Coal-field. Part ii. The Country around Cardiff, being an account of the region comprised in Sheet 263 of the Map. By Aubrey Strahan and T. C. Cantrill. London: E. Stanford, 1902. Size 10 × 6, pp. vi. and 148. *Map and Sections. Price 2s. 3d.*

United Kingdom—Water-Supply. **Beadle and May.**
The Underground Water Preservation Association, on the Underground Water-Supply of the Country Edited by Clayton Beadle and Wm May London · Published by the Association Size 9½ × 6, pp 104. *Map Price 1s Presented by the Association.*

ASIA.

Asia—Cartography. **Diest and Lucken.**
Asien 1 (1902): 69 70, 85 89, 117–119, 152–155, 165–169, 184–186
Der heutige Stand der Kartographie Asiens Von Oberst. W. v. Diest und Rittmeister O v Lücken *With Map.*

Asia—Historical. *Asien* 2 (1902): 12–14. **Wirth**
Alte west-östliche Beziehungen. Von Dr Albrecht Wirth

Ceylon. **Ferguson.**
The Ceylon Handbook and Directory and Compendium of Useful Information, to which is prefixed a Statistical Summary for the Colony, and specially for the Planting Enterprise: up to June, 1902. Compiled and edited by J. Ferguson. 1902. Size 8½ × 5½, pp. 1178. *Plans.*

China—Kiauchou **Maercker.**
Deutsch. Kolonialzeitung 19 (1902): 10, 22, 33, 42, 53, 70, 82, 97, 112, 121, 469, 479, 487, 498.
Die Entwicklung des Kiautschougebiets. Von Maercker. *With Maps and Illustrations.*

China—Mongolia *Asien* 1 (1902): 149–152, 186-190. **Faupel**
Peking—Urga. Ein Reisebericht von Faupel. *With Map and Illustrations.*

China and Japan **Blakeney**
On the coasts of Cathay and Cipango forty years ago. A Record of Surveying Service in the China, Yellow, and Japan Seas, and on the Seaboard of Korea and Manchuria. By William Blakeney. London: Elliot Stock, 1902. Size 9 × 5½, pp. xx. and 354 *Price 12s. net. Maps and Illustrations. Presented by the Publishers*

Eastern Asia. **Richthofen.**
Chrysanthemum und Drache. Vor und während der Kriegszeit in Ostasien. Skizzen aus Tagebüchen von Freiherrn Wilhelm von Richthofen. Berlin: F. Dümmlers, 1902. Size 9 × 6, pp. viii. 288. *Map and Illustrations. Price 6s.*

The author, who is a nephew of Baron von Richthofen, describes journeys in Japan, China, and Formosa, in the course of which he sometimes left the beaten track.

India. **Boeck.**

Durch Indien ins verschlossene Land Nepal. Ethnographische und photographische Studienblätter. Von Dr. Kurt Boeck. Leipzig: F. Hirt & Sohn, 1903. Size 10 × 6½, pp. xv. and 320. *Map and Illustrations. Price* 10*s.*

India **Connor and Roberts.**

Tide Tables for the Indian Ports for the Year 1903 (also January, 1904). Part i. Western Ports (Suez to Pámban Pass). Part ii. Eastern and Burma Ports (Galle to Port Blair). By Edwin Joscelyn Connor and E. Roberts. Size 6½ × 4, pp. 1204. *Price* 2 *rupees each Part. Presented by the Secretary of State for India.*

India. *Quarterly J.R. Meteorolog. S.* **28** (1902): 283–279. **Dallas.**

Earth Temperature Observations recorded in Upper India. By W. L. Dallas. *With Diagrams.*

India **Pullé.**

La Cartografia antica dell' India per Francesco L. Pullé. Parte i. Dai principi fino ai Bizantini e agli Arabi. *With Atlas.* (Studi Italiani di Filologia Indo-Iranica. Anno IV. Vol. iv. pp. xxiv. and 1–158.) Firenze: Tip. G. Carnesecchi e Figli, 1901. Size 9½ × 6. *Illustrations.* [To be reviewed.]

India. **Webber.**

The Forests of Upper India and their Inhabitants. By Thomas W. Webber. London: Edward Arnold, 1902. Size 9 × 6, pp. xiv and 344. *Maps. Price* 12*s.* 6*d. net. Presented by the Publishers.* [See review, *ante*, p 172.]

India—Census. ——

Census of India, 1901. Volume v.-B. Baluchistan. Part iii Provincial Tables. By R Hughes Buller. (Pp. 388. Bombay, 1902).—Volume xii. Burma. Part i. Report by C. C. Lowis. (Pp. iv., 152, lxxxiv., and vi Rangoon, 1902) —Volume xviii. Baroda. Part i. Report by Jamshedji Ardeshir Dalal. (Pp. xlii. and 652. Bombay, 1902) Volume xviii.-A. Baroda. Part ii. Tables. By J A. Dalal (Pp. 206. Baroda, 1902) —Volume xviii.-B. Baroda. Part iii. Provincial Tables. By J. A. Dalal. (Pp. 92. Baroda, 1902). *Maps, etc.* Size 13½ × 8½. *Presented by the Indian Government.*

India—Census. ———

Census of India, 1901. Vol. ii. Ajmer-Merwara. Part i. Report, by R. C. Bramley (pp. xviii. and 150. Ajmer, 1902). Vol. ii.-A. Ajmer-Merwara. Part ii. Tables by R. C. Bramley (pp. 210. Ajmer, 1902). Vols. v. and v.-A. (in one). Baluchistan. Part i. Report. Part ii. Imperial Tables, by R. Hughes-Buller (pp. 11, xii., 157, 6, and 84. Bombay, 1902). Vol. xiv. Coorg. Report and Tables, by W. Francis (Madras, 1902. Pp. v. and 62). Vol xv. Madras. Part i. Report, by W. Francis (Madras, 1902. Pp. x. and 234). Vol. xv.-A. Madras. Part ii. Imperial Tables, by W. Francis (Madras, 1902. Pp. iv. and 384). Vol. xv.-B. Madras. Part iii. Provincial Tables, by W. Francis (Madras, 1902. Pp. 240). Vol. xvii-A. Punjab (British Territory and Native States) and North-west Frontier Province. Part ii. Tables, by H. A. Ross (Lahore, 1902). Vol. xxi Gwalior. Part i. Report, by J. W. D. Johnstone (Lucknow, 1902. Pp. 174). Vol. xxi.-A. Gwalior. Part ii. Tables, by J. W. D. Johnstone (Lucknow, 1902. Pp 588). *Maps, Diagrams, etc. Presented by the Census Office, India.*

India—Delhi. **Fanshawe.**

Delhi, Past and Present. By H. C. Fanshawe. London: John Murray, 1902. Size 9 × 6, pp. xxii. and 338. *Maps and Plates. Price* 15*s. net. Presented by the Publisher.*

Intended rather as a guide to Delhi for the use of visitors, than a systematic history of the city, though an account is given of Delhi in the Hindu and Mohammedan periods.

India and Ceylon—Tea Industry. *Abh. K.K.G. Ges. Wien* **4** (1902): 1 66. **Kiefer.**

Die Theeindustrie Indiens und Ceylons (Entwickelung und Heutiger Stand). Von Dr. A. Kiefer. *With Map.*

Indian Ocean. **Alcock.**

A Naturalist in Indian Seas; or, Four Years with the Royal Indian Marine Survey Ship *Investigator.* By A. Alcock. London: John Murray, 1902. Size 9½ × 6, pp. xxiv. and 328. *Map and Illustrations. Price* 18*s. net. Presented by the Publishers.* [See review, *ante*, p. 179]

Indo-China. *B. Comité l'Asie Française* 2 (1902): 425-432. **Caix.**
Le traité franco-siamois. Par Robert de Caix. *With Maps.*

Indo-China. *A travers le Monde, Tour du Monde* 8 (1902): 341-342. ———
Le Traité franco-siamois. La nouvelle Frontière. Les Avantages politiques. *With Map.*

Japan—Bonin Islands. *Scottish G. Mag.* 18 (1902): 645-647. **Mason.**
Some Notes on the Bonin Islands. By W. B. Mason. *With Illustration.*

Japan—Formosa. *Scottish G. Mag.* 18 (1902): 561-576. **Campbell.**
Formosa under the Japanese: being Notes of a Visit to the Taichu Prefecture. By Rev. W. Campbell.

Malay Archipelago—Borneo. **Furness.**
The Home-Life of the Borneo Head-Hunters. Its Festivals and Folk-Lore. By William Henry Furness. Philadelphia: J. B. Lippincott & Co., 1902. Size 10 × 6½, pp. xii. and 190. *Plates. Presented by the Author* [Review, *ante*, p. 170.]

Malay Archipelago—Borneo. **Spaan**
Tijds. K. Ned. Aard. Genoots. Amsterdam 19 (1902): 515-584, 959-976.
Reis van Berouw naar Boelongan. Door A. H. Spaan. *With Maps.*

Malay States. **Belfield.**
Handbook of the Federated Malay States. Compiled by H. Conway Belfield. London: E. Stanford (not dated). Size 8½ × 5½, pp. iv. and 170. *Maps and Plates. Price* 2s. 6d. *Presented by the Publisher.*

Malay States. ———
Straits Settlements. Reports on the Federated Malay States for 1901. London: Eyre & Spottiswoode, 1902. Size 13½ × 8½, pp. 82. *Price* 9d.

Malay States—Tin. **Collet.**
Octave J. A. Collet. L'Étain. Étude minière et politique sur les États Fédérés Malais. Bruxelles: Falk Fils, [not dated]. Size 10 × 6½, pp. 196. *Map and Illustrations. Price* 5 *fr. Presented by the Publisher.*

Northern Japan. **Batchelor**
Sea-girt Yezo. Glimpses at Missionary Work in North Japan. By the Rev. John Batchelor. London: Church Missionary Society, 1902. Size 7½ × 6½, pp. viii. and 120. *Map and Illustrations. Price* 2s 6d. *Presented by the Editorial Secretary C.M.S.*

Persia. **Landor.**
Across Coveted Lands; or, A Journey from Flushing (Holland) to Calcutta, Overland. By A Henry Savage Landor. In two vols London: Macmillan & Co., 1902. Size 9 × 5½, pp. (vol. i.) viii. and 462; (vol. ii.) viii. and 460 *Maps and Illustrations. Price* 30s. *net. Presented by the Publishers.*

Persia. **Morgan and Gauthier.**
Mission Scientifique en Perse. Par J. de Morgan. Tome Troisième. Études Géologiques. Partie iii. Echinides. Supplément par V. Gauthier. Paris: E. Leroux, 1902. Size 11 × 9, pp. 109-190. *Plates.*

Persia. *Iz. Imp. Rus. G.S.* 38 (1902): 127-170. **Zarudnyi**
Preliminary Report on the Journey in Persia. By N. A. Zarudnyi. [In Russian.]

Russian Central Asia. *Globus* 82 (1902): 181-186. **Stenin.**
Das neue Taschkent, die russische Metropole in Zentralasien. Von P. v. Stenin. *With Illustrations.*

Russia—Kirghiz Steppe. *Zemlevedenie* (1902): 165-271. **Tikhonovich.**
Observations in the Kirghiz Steppes in the Seminalatunisk region. By N. Tikhonovich. [In Russian.] *With Map.*
See note in the Monthly Record.

Russia—Siberia—Altai. *Iz. Imp. Russ. G.S.* 38 (1902): 171-205. **Ignatoff.**
Exploration of Lake Teletskoi in the Altai in the summer of 1901. By P. G. Ignatoff. *With Maps.* [In Russian.]
Cf. note in the *Journal* for March, 1902, p. 370.

Russia—Siberia—Amur. *Questions Dipl. et Colon.* 14 (1902): 610-625. **Labbé.**
La région du fleuve Amour. Par Paul Labbé.

Russia—Siberia—Lake Baikal. *Iz. Imp. Russ. G.S.* **38** (1902): 228–271. **Drizhenko.**
Hydrographical Investigations in the Baikal. By Th. K. Drizhenko. *With Map.* [In Russian.] [See note, *ante*, p. 184.]

Siam. *Rev. Française* **27** (1902): 634–643. **Demanche.**
Le traité Franco-Siamois. Par G. Demanche. *With Maps.*

Siam. *Questions Dipl. et Colon.* **14** (1902): 449–456. ——
Le traité franco-siamois. *With Maps.*

AFRICA.

Algeria. **Cauvet.**
Renseignements Colon., Comité l'Afrique Française, No. 7 (1902): 137–143.
La culture du Palmier dans le Sud Algérien. Par le Capitaine Cauvet.

Algeria. *Quinzaine Colon.* **12** (1902): 637–641. **Chailley-Bert.**
L'Organisation de l'Algérie. Les territoires du Sud. Par J. Chailley-Bert.

Algeria. *Tour du Monde* **8** (1902): 493–516. **l'Harpe.**
Dans le Djebel-Amour. Par M. le Lieut. F. de l'Harpe. *With Illustrations.*

Algeria. *Rev. G.* **51** (1902): 527–536. ——
Territoires du Sud-Algérien. Par Gal M. *With Map.*

Ashanti—Gold-mining. **Daw.**
Ashanti Goldfields Corporation, Ltd. Lecture on the Development of Gold-mining on the Corporation's Property in Ashanti. By the General Manager and Consulting Engineer, John W. Daw. Size 10 × 8, pp. 94. *Plans and Illustrations. Presented by the Author.*

British East Africa—Uganda Railway. **Friedrich.**
Deutsche Rundschau G. **25** (1902): 72–77.
Die Ugandabahn. Von P Friedrich *With Map and Illustrations.*

British East Africa—Uganda Railway. ——
Africa. No. 4 (1902). Report by the Mombasa-Victoria (Uganda) Railway Committee on the Progress of the Works, 1901–1902. London: Eyre & Spottiswoode, 1902. Size 13 × 8½, pp. 16. *Maps and Section Price* 2*s.* 2½*d.*

Cape Colony. ——
Statistical Register of the Colony of the Cape of Good Hope for the year 1901, with Supplement partly for March Quarter, 1902, and partly for half-year ended June 30, 1902. Cape Town: W. A. Richards & Sons, 1902. Size 13 × 8, pp. xvi., 350. *Diagram. Presented by the Colonial Secretary.*

Cape Colony. ——
Cape of Good Hope. Department of Agriculture. Annual Report of the Geological Commission, 1900. Cape Town, 1901. Size 10 × 7½, pp. xvi. and 94.
This is noticed in the Monthly Record.

Central Africa. **Arnot.**
Garenganze: West and East. By F S. Arnot. London: W. G. Wheeler & Co. [not dated]. Size 6½ × 4½, pp. 142. *Map and Illustrations. Presented by the Author.*

A sketch of twenty years' work in South Central Africa, the earlier history related in the author's former work of the same name being much condensed.

Central Africa—Lake Kivu. **Maitre.**
B.S.G. Lille **37** (1902): 434–444; **38** (1902): 44–53, 112–121, 162–178.
Le bassin du lac Kivu. Par Henri Maitre.
Describes the results of journeys of the "White Fathers."

Dahome. *B.S.G. Marseille* **26** (1902): 153–165. **Borelli.**
Voyage au Dahomey. Conférence de Georges Borelli. *With Maps.*

Dahome. *Rev. Colon.* (1902): 501–530, 647–680. **Pradin.**
Secteur de Cabolé. Par R. Pradin. *With Map.*

Dahome—Railway. *Rev. Colon.* (1902): 681–706, 13–56. **Guyon.**
Chemin de fer du Dahomey: de la côte au Niger. Rapport de M. le commandant Guyon.

East Africa. **Toeppen**

Ali der ostafrikanische Seeräuber. Erzählungen aus dem Seeräuberleben der Lamu-Leute Ende der achtziger Jahre. Von Kurt Toeppen. Berlin: Dietrich Reimer (Ernst Vohsen), 1903. Size 9 × 6, pp. v. and 288. *Illustrations.* *Price 5m.* *Presented by the Publisher.*

Egypt. **Kelly.**

Egypt painted and described by R. Talbot Kelly London: A. & C. Black, 1902. Size 9 × 6½, pp. xiv. and 240. *Coloured Plates.* *Price 20s. net.* *Presented by the Publishers.* [See reviews, *ante.*]

Egypt. **Petrie and others.**

A History of Egypt. Vol. i. From the Earliest Times to the xvi[th] Dynasty. By W. M. Flinders Petrie. Fourth Edition, pp. xxiv. and 264.—Vol. ii. During the xvii[th] and xviii[th] Dynasties. 1896, with additions to 1898. By W. M. Flinders Petrie. Third Edition, pp. xvi. and 354.—Vol. iv. Under the Ptolemaic Dynasty. By J. P. Mahaffy. Pp. xiv. and 256.—Vol. v. Under Roman Rule. By J. Grafton Milne. Pp. xiv. and 262.—Vol. vi. In the Middle Ages. By Stanley Lane-Poole. Pp. xvi. and 382. London: Methuen & Co., 1898-1901. Size 8 × 5. *Maps and Illustrations.*

Egypt. **Barron and Hume.**

Notes on the Geology of the Eastern Desert of Egypt. By T. Barron and W. F. Hume, D.SC. London: Dulau & Co., 1902. Size 8½ × 5½, pp. 42. *Presented by the Publishers.*

Egypt. **Mardon.**

A Geography of Egypt and the Anglo-Egyptian Sudan. By H. W. Mardon. London, etc.: Blackie & Son, Ltd. Size 7½ × 5, pp. 214. *Maps and Illustrations.* *Two copies.* *One presented by the Author, the other by the Publishers.*

Although intended primarily for Egyptian schools, this book contains information which may be of use to a wider circle of readers. The mode of treatment is on the whole satisfactory.

Egypt. **Willcocks.**

The Nile Reservoir dam at Assuan, and after. [Cairo, 1902.] Size 10 × 6½, pp. 14. *Presented by the Author.*

A Prefatory Note to the work bearing the above title, urging the advantages of the equatorial lakes as storage reservoirs.

Egypt. *Scottish G. Mag.* **18** (1902): 637-645. ——

The Irrigation of Egypt: What the British have done. *With Maps and Illustrations.*

Based on Prof Brunhes' work.

Egypt—Geology. *C. Rd.* **135** (1902): 803 804. **Fourtau.**

Sur le Grès nubien. Note de R. Fourtau.

Egypt—White Nile. *B.S. Khédiv. G.* **5** (1902): 693-742 **Innes.**

Voyage au Nil Blanc, pour des recherches zoologiques. Par le Dr. W. Innes Bey. *With Illustrations.*

Fernando Po and Spanish Guinea. *B.R.S G. Madrid* **44** (1902): 190-317. **d'Almonte.**

Someras notas para contribuir á la descripción física, geológica y agrológica de la zona noroeste de la isla de Fernando Póo y de la Guinea continental española, con algunas observaciones sobre vias de comunicación y la colonización de aquellos territorios. Por Enrique d'Almonte. *With Sketches.*

French Congo. *B.S. Bretonne G.* **20** (1902): 337-359. **Toqué.**

Essai sur l'Origine et l'Évolution de la race Banda (Afrique Centrale). Par G. Toqué.

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Le Chari et le Bahr Sara. Georges Bruel. *With Map.*

Contests the view of M. Maistre that the Bahr Sara is the principal head-stream of the Shari

French Congo. **Löfler.**

Renseignements Colon., Comité l'Afrique Française No. **6** (1902): 121-128.

De la Sanga au Chari et à la Bénoué: les reconnaissances du capitaine Löfler. *With Map*

See note in Monthly Record for November, 1902 (p. 540).

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L'exploration du bassin de la Pokó. *With Map.*
The Poko is a tributary of the Ubangi.

French Guinea. **Normand.**
Renseignements Colon., Comité l'Afrique Française 7 (1902): 143–149.
Notes sur la Guinée française. Par Capitaine R. Normand.

German East Africa. *Kolon. Z.* 3 (1902): 391–393, 411–412, 447–449. **Herfurth**
Die Zwischenseenhochländer. Von A. Herfurth.

German South-West Africa. **Gerding.**
Die Bahn Swakopmund-Windhoek, von Gerding. Berlin: W. Susserott, 1902. Size 10 × 7, pp. 381–406. *Map and Illustrations. Price 2s.*

Madagascar. *Rev. Madagascar* 4 (1902): 385–417. **Jourdran.**
Mission médicale faite dans le Nord-Ouest de l'Ile. Par Dr. Jourdran. *With Illustrations.*

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Rev. Madagascar 4 (1902): 321–333, 408–420; 4 (2 Sem.) (1902): 22–38, 435–448.
Le bassin lacustre d'Alaotra à Madagascar. Par Dr. Laffay.

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Les travaux géographiques à Madagascar. Par Général Gallieni. *With Map.*

Nigeria. *Scottish G. Mag.* 18 (1902): 631–637. **Macalister.**
The Aro Country, Southern Nigeria. By Donald A. Macalister. *With Illustrations.*

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Dans les Marais du Haut Nil. Par Commandant Henry.
The author is an officer in the service of the Congo State.

Portuguese East Africa. *B.S.G. Lisboa* 20 (1902): 5–17. **Durão.**
Reconhecimento e occupação dos territorios entre o Messangire e os picos Namuli. Por Portugal Durão.

Sahara. *Rev. G.* 51 (1902): 335–343. **Dornin.**
Du Tidikelt au Niger. Par Pierre Dornin. *With Map.*
Discusses the question of communication across the Sahara in the light of Lieut. Cottonest's journey.

Sahara. *B.S.G. Marseille* 26 (1902): 207–216. **Lugan.**
Souvenirs de colonne au Sahara. Par Colonel Lugan.

Senegal. *Rev. Colon.* (1902): 87–124, 377–423, 551–606, 707–744. **Courtet.**
Étude sur le Sénégal. Par M. Courtet. *With Maps.*

Senegal. **Tellier.**
G. Tellier. Autour de Kita. Étude Soudanaise. Paris, etc.: H. C. Lavauzelle [not dated]. Size 10 × 6½, pp. 316. *Maps. Price 5s.*
A detailed account of a district in the upper basin of the Senegal.

Somaliland. **McNeill.**
In Pursuit of the "Mad" Mullah. Service and Sport in the Somali Protectorate. By Captain Malcolm McNeill. With a chapter by Lieut. A. C. H. Dixon. London: C. Arthur Pearson, Ltd., 1902. Size 8 × 5, pp. xi. and 314. *Plan and Illustrations. Price 6s. Presented by the Publishers.*

South Africa—Historical. *La G., B.S.G. Paris* 6 (1902): 281–288. **Dehérain.**
Voyage du landdrost Starrenburg au nord du Cap de Bonne-Espérance en 1705. Par E. Dehérain.

South Africa—Labour Question. *Nineteenth Century* 52 (1902): 724–731. **Johnston.**
The Native Labour Question in South Africa. By Sir Harry H. Johnston, G.C.M.G., etc.

Spanish Guinea. *B.R.S.G. Madrid* 44 (1902): 48–69. **Coso.**
Demarcación de la Guinea española. Por el capitán de Estado Mayor D. Manuel Nieves Coso. *With Map.*

Tunis. *Questions Dipl. et Colon.* 14 (1902): 518–524. **Pensa.**
L'avenir de la Tunisie. L'industrie européenne et l'industrie indigène. Par Henri Pensa.

Uganda. **Hobley.**

Eastern Uganda, an Ethnological Survey. By C. W. Hobley. (Anthropological Institute, Occasional Papers, No. 1.) London: Anthropological Institute, 1902. Size 11 × 7½, pp. 96. *Map and Plates. Price* 10*s. net. Presented by the Anthropological Institute.*

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West Africa. ———

Hints and Suggestions for Travelling on the West Coast of Africa. London: Bishop & Co. [not dated]. Size 6½ × 4½, pp. 30. *Price* 1*s. Presented by the Publishers.*

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Alaska. *Popular Sci. Monthly* **62** (1902): 183-181. **Hollister.**

The Size of Alaska. By George B. Hollister. *With Map.*

Canada. **Tyrrell.**

Department of the Interior. Report on an Exploratory Survey between Great Slave lake and Hudson Bay, Districts of Mackenzie and Keewatin. By J. W. Tyrrell. (Appendix No. 26, Part iii., Annual Report, 1901.) Ottawa, 1902. Size 10 × 6½, pp. 62. *Illustrations. Presented by the Surveyor-General of Canada.*

See note in *Journal* for September, 1902 (p. 340).

Canada. ———

Fourth Annual Report of the Geographic Board of Canada for the year ending June 30, 1902. (Supplement to the Thirty-fifth Annual Report of the Department of Marine and Fisheries. Marine.) Ottawa, 1902. Size 10 × 6½, pp. 16.

Gives decisions from July 1, 1901, to June 30, 1902. Among the forms adopted are Athabaska, Backs river (not Great Fish river), Dubawnt river (not Doobaunt), Thelon river (not Ark-e-leenik).

Mexico. **Schiess.**

Quer durch Mexiko. Vom Atlantischen zum Stillen Ocean von Dr. Wilhelm Schiess. Berlin: Dietrich Reimer (Ernst Vohsen), 1902. Size 10½ × 7, pp. xiii. and 234. *Map and Illustrations. Price* 8 *m. Presented by the Publishers.*

Mexico—Vera Cruz. ———

Veracruz Port-Works. Descriptive Memoir of the great undertaking which is to-day being inaugurated. March 6, 1902. Size 9 × 6½, pp. 22. *Plan and Illustrations. Presented by Mr. Henry A. Case.*

North America—Historical. **Fischer and Soulsby.**

The Discoveries of the Norsemen in America, with special relation to their cartographical representation. By Joseph Fischer. Translated from the German by Basil H. Soulsby. London: Henry Stevens, Son & Stiles, 1903. Size 10½ × 6½, pp. xxiv. and 130. *Maps. Presented by the Translator and Publishers.*

[See reviews, *ante*, p. 181.]

North America—Historical. **Henry, Thompson, and Coues.**

New Light on the Early History of the Greater North-West. The Manuscript Journals of Alexander Henry, Fur Trader of the North-West Company, and of David Thompson, Official Geographer and Explorer of the same Company, 1799–1814. Exploration and Adventure among the Indians on the Red, Saskatchewan, Missouri, and Columbia rivers. Edited with Copious Critical Commentary by Elliot Coues. In three Volumes. Vol. i. The Red River of the North (pp. xxviii. and 446); Vol. ii. The Saskatchewan and Columbia Rivers (pp. vi. and 447–916); Vol. iii. Index and Maps (pp. 917-1028). New York: Francis P. Harper, 1897. Size 9 × 6. *Maps and Portrait. Price* £2 10*s.*

United States—Massachusetts. *J. Geology* **10** (1902): 513-517. **Cleland.**

The Landslides of Mounts Greylock and Briggsville, Mass. By H. F. Cleland. *With Map and Illustration.*

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Geological Survey of Missouri. Vol. xii. part ii. Sheet Reports Nos. 6–10. Reports on Areal Geology. By Curtis F. Marbut. Published by the Geological Survey. Jefferson City, 1898. Size 10 × 7, pp. 17–372. *Maps and Plates. Two copies, one presented by the Survey, the other by Mr. C. F. Marbut.*

United States—Missouri. **Marbut.**
The Evolution of the Northern Part of the Lowlands of South-Eastern Missouri. By C. F. Marbut. (The University of Missouri Studies. Volume i. No. 3, 1902.) Size 10 × 7, pp. viii. and 64. *Maps and Plates. Price* $1.25.
This was noticed in the Monthly Record for January (p. 82).

United States—New England. **Davis.**
River Terraces in New England. By W. M. Davis. (Bulletin Museum Comparative Zoology at Harvard College, vol. xxxviii., Geological Series, vol. v. No. 7.) Cambridge, Mass., 1902. Size 10 × 6½, pp. 281–346. *Diagrams.*

United States—Texas. *J. Franklin I.* **154** (1902): 143–156, 225–238, 263–281. **Hill.**
The Beaumont Oil Field, with Notes on other Oil Fields of the Texas Region. By Robert T. Hill. *Map and Section. Also separate copy, presented by the Author.*

CENTRAL AND SOUTH AMERICA.

Argentine Republic—Historical. *An. S. Ci. Argentina* **54** (1902): 113–187. **Outes.**
El primer establecimiento español en el territorio argentino (1527–1902). Noticia histórico-geográfica. Por Félix F. Outes. *With Maps.*

Bolivia. ——
Carta geográfica del N. O. de Bolivia, La Paz, 1902. Size 11 × 7½, pp. 6. *Map.*
Shows the frontiers claimed by Peru, Bolivia, and Brazil in this region.

Brazil—Bahia. *Rev. I.G. e Hist. Bahia* **8** (1901): 19–30. **Praguer.**
Riqueza mineral do Estado da Bahia. Phenomenos geologicos e mineralogicos, especialmente na zona de Santo Amaro. Por Henrique Praguer.

Central America. *G.Z.* **8** (1902): 489–515. **Sapper.**
Die mittelamerikanische Landschaft. Von Dr. Karl Sapper. *With Plates.*

Central America—Canal. **Serrell.**
The American Isthmian Canals. The Darien Mandingo Canal. By Edward Wellman Serrell. New York, 1902. Size 9½ × 6½, pp. 16. *Presented by Colonel G. E. Church.*

Central America—Canal. **Serrell.**
The American Isthmian Canals. The Darien Mandingo Canal. By Edward Wellman Serrell. New York, 1902. Size 9½ × 6½, pp. 16. *Presented by the Author.*

Chile. *Internat. Quarterly* 1 (1902): 1–252. ——
Brief Notes on Chile. Geographical Situation, Boundaries, Extent and Surface, General Description, Climate, Productions, Population, History, Government, Industry and Commerce; Description of Provinces; General Catalogue of Exhibits at Pan-American Exposition, with List of Awards. *With Illustrations.*

Colombia. **Vergara y Velasco.**
Nueva Geografia de Colombia escrita por regiones naturales por F. J. Vergara y Velasco. Tomo i. Geografia General. Bogota, 1901. Size 10 × 7, pp. viii., 1008, lxxiv., and 46. *Maps and Illustrations.*
This will be reviewed elsewhere.

Guatemala. *Petermanns M.* **48** (1902): 193–195. **Sapper.**
Das Erdbeben in Guatemala vom 18. April 1902. Von Prof. Dr. Karl Sapper. *With Map.*

Jamaica—Bibliography. **Cundall**
Bibliographia Jamaicensis. A List of Jamaica Books and Pamphlets, Magazine Articles, Newspapers, and Maps, most of which are in the Library of the Institute of Jamaica. By Frank Cundall. Kingston, Jamaica, [1902]. Size 8½ × 5½, pp. 84. *Presented by the Institute of Jamaica.*

Orinoco. **Triana.**
Down the Orinoco in a Canoe. By S. Pérez Triana. With an Introduction by R. B. Cunninghame Graham. London: W. Heinemann, 1902. Size 8 × 5, pp. xvi. and 254. *Map. Price* 6s.

Patagonia. *Rev. Museo La Plata* **10** (1902): 269–281. **Lehmann-Nitsche.**
La pretendida existencia actual del Grypotherium, supersticiones araucanas referentes á la lutra y al tigre. Por Dr. Robert Lehmann-Nitsche.

West Indies—Eruptions. *American J. Sci.* **14** (1902): 319–350. **Hovey.**
Observations on the Eruptions of 1902 of La Soufrière, St. Vincent, and Mount Pelée, Martinique. By E. O. Hovey. *With Maps and Illustrations.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australasia. *G.Z.* **8** (1902): 425–450, 516–534. **Ratzel.**
Der australische Bund und Neuseeland. Von F. Ratzel.
An outline of existing conditions in Australasia.

Fiji—Meteorology. **Vaughan.**
Fiji. Meteorological Observations taken at Suva during 1901. By J. D. W. Vaughan. Suva: E. J. March, 1902. Size 13½ × 8½, pp. 16.

Hawaii. *Monthly Weather Rev.* **30** (1902): 364–368. ——
Meteorology in Hawaii. *With Maps.*

New Guinea. *Globus* **82** (1902): 247–253. **Weule**
Zwergvölker in Neu-Guinea? Von Prof. Dr. K. Weule. *With Illustrations.*

New South Wales. *J. and P.R.S. New South Wales* **35** (1901): 223–242. **McKinney.**
Projects for Water Conservation, Irrigation, and Drainage in New South Wales. By H. G. McKinney.

New South Wales. **Coghlan.**
The Wealth and Progress of New South Wales, 1900–01. By T. A. Coghlan. Sydney: W. A. Gullick, 1902. Size 9 × 5½, pp. xvi. and 1044. *Map. Presented by the Agent-General for New South Wales.*

New South Wales. ——
1902. Legislative Assembly. New South Wales. Annual Report of the Department of Mines, New South Wales, for the year 1901. Sydney: W. A. Gullick, 1902. Size 13 × 8, pp. 196. *Maps, Diagrams, and Illustrations. Price 7s. 6d. Presented by the Agent-General for New South Wales.*

New South Wales. ——
The Year-Book of New South Wales. Compiled by the Editor of the Year-Book of Australia for circulation by the Agent-General in London, 1903. Size 8½ × 5½, pp. 168. *Map. Presented by the Agent-General for New South Wales.*

New South Wales - Historical. **Bladen.**
Historical Records of New South Wales. Vol. vii. Bligh and Macquarie, 1809, 1810, 1811. Edited by F. M. Bladen. Issued by direction of the Honorable J. Perry. Sydney: W. A. Gullick, 1901. Size 8½ × 5½, pp. lx. and 690. *Plan and Plates. Presented by the N.S.W. Government.*

One of a valuable series of volumes in course of publication, in which practically the whole of the Records relating to the foundation, progress, and government of New South Wales are being printed in full.

New Zealand. *T. and P. New Zealand I.* **34** (1901): 362–386. **Carse.**
On the Flora of the Manku District. By H. Carse.

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On the Secular Movements of the New Zealand Coast-line. By Prof. James Park.

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The New Zealand Official Year-Book, 1902. Prepared . . . by E. J. von Dadelszen. Wellington, N.Z.: J. Mackay, 1902. Size 8½ × 5½, pp. vi. and 690. *Maps, Diagrams, and Illustrations.*

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Problems of the Pacific—New Zealand. By H. D. Lloyd.

Pacific—Rurutu and Rimatara. *Rev. Colon.* (1902): 1–11. **Garnier.**
Rapport sur le percement des passes de Rurutu et de Rimatara, adressé par le capitaine de port de Papeete à M. le Gouverneur des établissements français de l'Océanie. *With Illustrations.*

Queensland. *Queensland G.J.* **17** (1901–1902): 33–48. **Traill.**
Mount Coot-tha Reserve. By W. H. Traill. *With Illustrations.*

Queensland. ——

1902. Queensland. Report of the Registrar-General on Agricultural and Pastoral Statistics for 1901. Size 13 × 8, pp. 70.

POLAR REGIONS.

Antarctic. *B.S.R. Belge G.* 26 (1902): 446–450. **Lecointe.**

La Terre Alexandre 1er. Par G. Lecointe.

Discusses the identity of lands seen by Bellingshausen and by the Belgian Antarctic Expedition.

Arctic. *Church Miss. Intelligencer* 27 (1902): 898–904. **Peck.**

Arctic Travelling: Two Hundred Miles in an Open Boat. Notes of a Journey from Cumberland Sound to Frobisher Bay. By the Rev. E. J. Peck.

Arctic—Peary's Expedition. *B. American G.S.* 34 (1902): 337–340 ——

Mr. Peary's Return. *With Map.*

Polar Exploration. **Hassert**

Die Polarforschung. Geschichte der Entdeckungsreisen zum Nord- und Südpol von den ältesten Zeiten bis zur Gegenwart. Von Prof. Dr. Kurt Hassert. Leipzig: B. G. Teubner, 1902. Size 7½ × 5, pp. iv. and 156. *Maps.*

MATHEMATICAL GEOGRAPHY.

Astronomy—Star Catalogue. **Kam.**

Catalog von Sternen, deren Oerter durch selbstständige Meridian-Beobachtungen bestimmt worden sind, aus Band 67 bis 112 der Astronomischen Nachrichten reducirt auf 1875, o von Dr. N. M. Kam, nach dessen Tod herausgegeben von H. G. Van de Sande Bakhuyzen. Amsterdam: Joh. Müller, 1901. Size 12 × 10½, pp. x. and 368. *Presented by the K. Akademie van Wetenschappen, Amsterdam.*

Cartography. ——

Service Géographique de l'Armée. Rapport sur les travaux exécutés en 1901. Paris, 1902. Size 10 × 6½, pp. 40. *Maps.*

Besides the survey work in France, Algeria, and Tunis, progress has been made with the new edition of the map of Africa, and with maps of parts of Europe, Asia, and America, on the scale of 1 : 1,000,000.

Cartography—Areas. *Petermanns M.* 48 (1902): 213–215. **Wagner.**

Die Einführung von Flächenzahlen auf den Karten Von Prof. Dr. Hermann Wagner.

Cartography—Map-collection. ——

Musée rétrospectif de la Classe 14. Cartes et appareils de géographie et de cosmographie. Topographie, à l'Exposition Universelle Internationale de 1900, à Paris. Rapport du Comité d'Installation. Size 11 × 7½, pp. 86. *Illustrations. Presented by M. Henri Sarrian.*

Surveying. **Burrard.**

Hand-Book of Professional Instructions for the Trigonometrical Branch, Survey of India Department. [Second Edition.] Prepared by Major S. G. Burrard. Calcutta, 1902. Size 10 × 6, pp. xii., 268, and 46. *Presented by the Surveyor-General.*

Tide gauges. *P.I. Civil Engineers* 149 (1902): 223–244. **Dawson.**

Tide-gauges in Northern Climates and Isolated Situations. By Dr. W. B. Dawson. *With Map and Diagrams. Also separate copy, presented by the Author.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Climatology. *Z. Ges. Erdk. Berlin* (1902): 611–629, 671–693. **Frech.**

Studien über das Klima der geologischen Vergangenheit. Von Prof. Dr. Fritz Frech. *With Maps.*

Geomorphology—Hanging Valleys. **Garwood.**
Quarterly J. Geolog. S. 58 (1902): 703–718.

On the origin of some Hanging Valleys in the Alps and Himalayas. By Prof. E. J. Garwood. *With Map and Plates.*

Geomorphology—Moors. *Scottish G. Mag.* 18 (1902): 587–597. **Smith.**
The Origin and Development of Heather Moorland. By Dr. W. G. Smith.

A careful analysis of the work on the German heaths by Graebner (*Journal*, vol. xx. p. 551).

Gravity. *C. Rd.* 135 (1902): 774–776. **Collet.**
La pesanteur le long du parallèle moyen. Note de J. Collett.

Kumatology. *J. Manchester G.S.* 17 (1901): 197–221. **Greenwood.**
The Life of a Wave from its Cradle to its Grave. By Captain W. Nelson Greenwood. *With Illustrations.*

Kumatology—Ripple-marks and Dunes. **Bertololy.**
Kräuselungsmarken und Dünen. Von Dr. Ernst Bertololy. (Münchener Geographische Studien, herausgegeben von Siegmund Günther. Neuntes Stück.) München: T. Ackermann, 1900. Size 9½ × 6, pp. iv. and 190.

Meteorology. *J.G.* 1 (1902): 400–402. **Jefferson**
The Influence of Ponds and Rivers on Atmospherical Temperatures. By Prof. M. S. W. Jefferson.

Oceanography. **Schott**
Wissenschaftliche Ergebnisse der Deutschen Tiefsee-Expedition auf dem Dampfer "Valdivia" 1898–1899. Im Auftrage des Reichsamtes des Innern herausgegeben von Carl Chun. Erster Band. Oceanographie und Maritime Meteorologie im Auftrage des Reichs-Marine-Amtes bearbeitet von Dr. Gerhard Schott. Text and Atlas. Jena: Gustav Fischer, 1902. Size 13½ × 10½, pp. xii. and 404. *Diagrams, Map, and Illustrations.*

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Oceanography. **Krümmel.**
Das Wissen der Gegenwart. Deutsche Universal-Bibliothek für Gebildete. 52 Band. Der Ozean. Eine Einführung in die Allgemeine Meereskunde. Von Dr. Otto Krümmel. Zweite, Durchweg Verbesserte Auflage. Wein and Prag: F. Tempsky; Leipzig: G Freytag. 1902. Size 7½ × 5, pp. viii. and 286. *Maps and Illustrations. Price* 4m.

Oceanography—Currents. **Russell**
J. and P.R.S. New South Wales 35 (1902): 330–346.
Current Papers, No. 6. By H. C. Russell. *With Charts. Also separate copy, presented by the Director of the Sydney Observatory.*

Oceanography—Soundings. *Ann. Hydrographie* 30 (1902): 513–515. **Simonsen**
Lothungen an der ostküste Südamerikas. Von Kapt. A. Simonsen

Oceanography—Soundings. *Ann. Hydrographie* 30 (1901): 516–532. ——
Die Lothungsreise des Kabeldampfers "von Podbielski" über den Nordatlantischen ozean im Sommer 1902. *With Chart.*

Snow. *Rev. Museo La Plata* 10 (1902): 313–326. **Hauthal**
Nieve penitente. Por Rodolfo Hauthal. *With Plates*

Cf. note in the *Journal* for September, 1902 (p. 347).

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Commercial—Chinchona. *Abh. K.K.G. Ges Wien* 4 (1902): 1–44. **Dronke.**
Die Verpflanzung des Fieberrindenbaumes aus seiner Südamerikanischen Heimat nach Asien und anderen Ländern. Von Julius Dronke. *With Maps.*

Historical—Gerritsz. **Wichmann.**
Dirck Gerritsz. Ein Beitrag zur Entdeckungsgeschichte des 16ten und 17ten Jahrhunderts Von Dr Arthur Wichmann. Groningen: J. B. Wolters, 1899 Size 10 × 6½, pp. 104.

A valuable monograph on Dirck Gerritsz and his voyages. Translations of hitherto unpublished documents are given.

Historical—Mile. *Rev G. Italiana* 9 (1902): 473–498 **Uzielli.**
Antonio di Tuccio Manetti, Paolo Toscanelli e la lunghezza delle miglia nel Secolo delle Scoperte. Per Gustavo Uzielli.

Historical—Travel. *B.S.R. Belge G.* 26 (1902): 379–404. **Du Bois.**
L'Évolution des voyages. Par Albert Du Bois.

Political Geography—Boundaries. *B.S.G. Com. Bordeaux* **28** (1902): 341–348. **D'Almeida.**

La notion des frontières en géographie politique. By P. Camena d'Almeida.

Population of Cities. *La G., B.S.G. Paris* **6** (1902): 313–321. **Weinreb.**

Les grandes cités du monde. By T. Weinreb.

Gives the populations according to recent censuses.

BIOGRAPHY.

Bright. **Bright.**

The Life Story of the Late Sir Charles Tilston Bright, Civil Engineer: with which is incorporated the story of the Atlantic Cable, and the first telegraph to India and the Colonies. By his brother, Edward Brailsford Bright, and his son, Charles Bright. 2 volumes. Westminster: A. Constable & Co, [not dated]. Size 9 × 5½, pp. (vol. i.) xx. and 506; (vol. ii.) xii. and 702. *Portraits and Illustrations. Presented by Mr. Charles Bright.*

Gastaldi. **Grande.**

Stefano Grande. Notizie sulla vita e sulle opere di Giacomo Gastaldi, Cosmografo Piemontese del Secolo XVI. Con Prefazione di Luigi Hugues. Torino: Carlo Clausen, 1902. Size 9½ × 6½, pp. 100.

Powell *Science* **16** (1902): 782–790. ..

In Memory of John Wesley Powell.

On the proceedings of a meeting convened by the Smithsonian Institution.

Vasco da Gama. **Telles da Gama**

Le Comte-Amiral D. Vasco da Gama Par D. Maria Telles da Gama. Paris: A. Roger and F. Chernoviz, 1902. Size 10½ × 7½, pp xxvi. and 340. *Map, Portraits and Illustrations. Price* 25s.

GENERAL.

Almanac. ——

Annuaire pour l'an 1903, publié par le Bureau des Longitudes. Avec des Notices Scientifiques. Paris: Gauthier Villars. Size 6½ × 4, pp. viii., 668, 54, 10, 4, 34, and 38.

Encyclopædia Britannica. ——

The New Volumes of the Encyclopædia Britannica, constituting, in combination with the existing volumes of the Ninth Edition, the Tenth Edition of that work. The eighth (ninth) of the new volumes, being volumes xxxii. (xxxiii.) of the complete work. London, etc., 1902. Size 11 × 8½, pp. (vol xxxii.) xxxviii. and 872, (vol xxxiii.) xviii. and 946. *Illustrations, etc*

The body of the work is completed by these volumes, only the maps and Index being still to appear.

Encyclopædia Britannica. ——

The New Volumes of the Encyclopædia Britannica. . . . The sixth (seventh) of the New Volumes, being Volume xxx. (xxxi.) of the Complete Work. London: A. & C. Black; and the *Times*, 1902. Size 11½ × 8½, pp (vol. xxx.) xv. and 846; (vol. xxxi.) xx. and 910. *Maps and Illustrations.*

The more important geographical articles in these volumes include Limnology and Oceanography, by Dr. H. R. Mill; Malay Archipelago, by Dr. H. O. Forbes; Map, by E. G. Ravenstein and Dr. S. Ruge; and Polar Regions, by Sir Clements Markham, Dr. Nansen, and Dr. H. R. Mill.

French Colonies. *Questions Dipl. et Colon.* **14** (1902): 665–681. **Buret**

Les villes de santé dans nos Colonies. Par Maurice Buret.

Geography. *P. American Philosoph. S.* **41** (1902): 235–259. **Davis.**

Systematic Geography. By W. M. Davis.

Geography. **Günther**

Entdeckungsgeschichte und Fortschritte der wissenschaftlichen Geographie im neunzehnten Jahrhundert. Von Dr. Siegmund Günther. Berlin: S. Cronbach, 1902. Size 7½ × 5, pp. 232. *Price* 2s. 6d.

An excellent summary of progress in exploration and scientific geography during the nineteenth century.

Norwegian Language. **Poestion.**
Norwegisches Lesebuch. Lesestücke in der norwegischen Reichssprache. Mit einem Anhange von Lesestücken im "Landsmaal" nebst grammatikalischen Vorbemerkungen über das "Landsmaal" und zwei Glossaren. Von J. C. Poestion. Wien, etc.: A. Hartleben [not dated]. Size 7 × 4½, pp. viii. and 184. *Price 2m. Presented by the Publisher.*

Telegraphic Code. **Atkinson.**
The Via Eastern Telegraphic Social Code. Issued under the Authorization of the Eastern Telegraph Company, etc. Compiled by Robert T. Atkinson. London: W. Hutchinson & Co., 1902. Size 8 × 5½, pp. 320. *Price 5s. net. Map. Presented by the Publishers.*

Travel. **Boehm.**
Over the World. By Sir Edgar Collins Boehm, Bart. London: Horace Cox, 1902. Size 7½ × 5, pp. xiv. and 366. *Illustrations. Presented by the Publishers.*

Year-book. **Trübner.**
Minerva. Jahrbuch der Gelehrten Welt. Herausgegeben von Dr. K. Trübner. Zwölfter Jahrgang, 1902–1903. Strassburg: Karl J. Trübner, 1903. Size 6 × 4½, pp. xl. and 1332. *Portrait.*

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Austria-Hungary. **Artaria.**
Eisenbahn- u. Postkarte von Oesterreich-Ungarn. Vierte Neubearbeitung. 3 Auflage. Scale 1 : 1,500,000 or 23·6 stat. miles to an inch. Vienna: Verlag von Artaria & Co., 1903. *Price* 2.20 *kronen. Presented by the Publishers.*

England and Wales. **Ordnance Survey.**
Ordnance Survey of England and Wales:—Revised sheets published by the Director-General of the Ordnance Survey, Southampton, from December 1 to 31, 1902.

1 inch:—

With hills in brown or black, 79, 89, 102, 103, 104, 120, 142, 165 (engraved). 1s. *each.*

Printed in colours: 95 and 107 (combined), 1s. 6d. 108, 109, 110, 112, 113, 115, 123, 126, 149, 155. 1s. *each.*

6-inch—County Maps:—

Cambridgeshire, 28 S.E., 33 N.W. **Dorsetshire**, 3 S.W., 7 S.W., 32 N.W., 41 N.W., S.W., S.E., 49 S.W., 50 N.E., 55 N.W. **Huntingdonshire**, 19 S.E., 20 S.W., 28 N.W. **Montgomeryshire**, 15 N.W., 16 N.W., 19 S.W., 20 N.W., N.E., S.W., 21 S.E., 22 N.E. **Shropshire** (5A S.E. and 5 S.W.), 12 N.W., 21 S.E., 28 S.W., 39 N.E., 40 N.W. **Staffordshire**, 46 S.E., 50 N.E., 52 N.E., S.W., 56 S.E., 58 S.W., 59 S.W. 1s. *each.*

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Cambridgeshire, XIII. 5, 9; XXVII. 14; XXXI. 14, 15; XXXIX. 5; XL. 1, 2, 4, 5; XLVI. 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16; XLVII. 13, 15, 16; XLVIII. 5; LIII. 2, 3, 6, 9, 10, 13; LV. 13. **Dorsetshire**, XXI. 5, 15, 16; XXX. 5, 7, 9, 15; LIV. 8; LVIII. 15. **Gloucestershire**, X. 6; XV. 15; XXII. 16; XXVII. 7, 8, 9, 10, 11, 12, 14; XXIX. 8, 11; XLIII. 8, 9, 11, 12; XLIV. 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 15, 16; XLV. 1, 9; XLVI. 2; LII. 7, 8; LIV. 8. 10; LVIII. 12, 14; LX. 11; LXV. 12, 15; LXVIII. 8, 15, 16; LXX. 13, 14; LXXIV. 13. **Leicestershire**, V. 5, 13; IX. 8, 16. **Montgomeryshire**, XXX. 16; XXXI. 14; XXXVI. 16; XXXVII. 6, 8, 9, 11, 15; XXXVIII. 3, 6, 8; XLIII. 8, 10, 13; XLVII. 16; XLVIII. 7, 9, 10, 11, 15; LII. 2. **Radnorshire**, III. 15; IIIA. 16; VII. 15, 16; VIII. 2, 8. **Shropshire**, XLVI. 16; XLVII. 3, 4, 7, 8, 10, 14; XLVIII. 4; LI. 14; LIII. 8; LIV. 1, 6, 8; LV. 3, 14; LVIII. 1, 2, 3, 4, 5, 6, 7, 10, 11; LIX. 9, 10; LXIII. 1, 5, 11. **Staffordshire**, LXII. 11, 12; LXIII. 12; LXV. 6. **Warwickshire**, V. 6. **Worcestershire and Do. (Det.** Nos. 4, 6, and 7); VIII. 14; XIV. 2, 3, 5, 6, 7. 8, 9, 10, 11, 12; LVIII. 15; LXII. 16; LXIII. 9, 13. **Yorkshire**, CCLXXXIV. 10; CCLXXXV. 9; CCLXXXVI. 5, 9; CCLXXXIX. 16; CCXC. 9; CCXCII. 1, 5. 3s. *each.*

4 miles to 1 inch—Miscellaneous Maps:—

Petty Sessional Division Maps in colour:—Herefordshire, Lancashire, Norfolk, Northamptonshire, Nottinghamshire, Oxfordshire, Pembrokeshire, Radnorshire, Somerset, Staffordshire, Surrey, Sussex, Warwickshire, Westmorland, Wiltshire, Yorkshire (North Riding), Yorkshire (West Riding). *6d. each.*

(*E. Stanford, London Agent.*)

England and Wales. **Bartholomew.**

The Survey Atlas of England and Wales. A series of eighty-four plates of maps and plans, with Descriptive Text, illustrating the Topography, Physiography, Geology, Climate, and the Political and Commercial Features of the Country. Designed by and prepared under the direction of J. G. Bartholomew, F.R.S.E., F.R.G.S. Edinburgh: John Bartholomew & Co. Under the patronage of the Royal Geographical Society. 1903. *To be published in twenty-one monthly parts at 2s. 6d. each.*

A special notice of this atlas is given in this number of the *Geographical Journal*, p. 164.

Europe. **Bureau International des Administrations Télégraphiques, Bern.**

Carte des Communications Télégraphiques du Régime Européen, dressée d'après des documents officiels par le Bureau International des Administrations Télégraphiques. Scale 1 : 5,150,000 or 81·1 stat. miles to an inch. 4 sheets. Bern: Bureau International des Administration Télégraphiques.

ASIA.

Asia Minor. **Fitzner.**

Regenkarte von Klein-Asien. Von R. Fitzner. Scale 1 : 3,700,000 or 58·3 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Ergänzungsheft No. 140. Gotha: Justus Perthes, 1902. *Presented by the Publishers.*

Asia Minor. **Kiepert.**

Karte von Kleinasien. Scale 1 : 400,000 or 6·3 stat. miles to an inch. Von Dr. Richard Kiepert. Sheet B. V., Siwas. Berlin: Dietrich Reimer (Ernst Vohsen), 1902. *Price 6 marks.*

There are now altogether nine sheets of this map published out of the twenty-four of which it will consist when complete. The present sheet includes the area between 38° 50′ and 40° 40′ N. lat., and 36° 20′ and 39° 30′ E. long. It is in every respect similar, as regards style of production, to those previously published, the hill work being in brown, with the lettering, roads, and rivers in black.

China. **Madrolle and Baille.**

Atlas de l'Empire Chinois Par Cl. Madrolle el A. Baille. Scale 1 : 3,000,000 or 47·3 stat. miles to an inch. Sheets: Canton, Peking. Paris, 1900–1901. *Price 1.50 fr. each sheet.*

It has been attempted to give a good deal of information on these sheets, notwithstanding their comparatively small scale (1 : 3,000,000) and somewhat rough appearance. They show the territories conceded to European power, ports open to foreign commerce, mission stations, lighthouses, limit of the navigability of rivers, altitudes, the character and relative importance of Chinese cities and towns, canals, railways, steamers, and telegraph lines, and other information. There is also an inset showing the languages of Southern China.

Japan. **Yamasaki.**

Tiefenkarte des japanischen Binnenmeeres Setouchi. Von Dr. N. Yamasaki. Scale 1 : 600,000 or 9·4 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1902, Taf. 20. Gotha: Justus Perthes. *Presented by the Publisher.*

AFRICA.

Africa. **Intelligence Division, War Office.**

Africa. Scale 1 : 1,000,000 or 15·7 stat. miles to an inch. Sheet 88, Juba river. London: Intelligence Division, War Office. Stanford. *Price 2s. Presented by the Director-General of Mobilisation and Military Intelligence.*

Africa. **Niox.**

G. Niox. Atlas de Géographie Général. Afrique. Fascicule spécial de cinq feuilles. No. 26, Afrique d' ensemble, scale 1 : 16,000,000 or 252·5 stat. miles to an inch; No. 28, Algérie et Tunisie, scale 1 : 2,000,000 or 31·5 stat. miles to an inch;

No. 23bis. Région saharienne française, scale 1 : 4,000,000 or 63·1 stat. miles to an inch; No. 24, Senegal-Niger, scale 1: 8,000,000 or 126·2 stat. miles to an inch; No. 24bis, Congo-Nil, scale 1 : 8,000,000 or 126·2 stat. miles to an inch. Paris: Ch. Delagrave, 1903. *Price* 6 *fr. Presented by the Publisher.*

In addition to a general map of Africa on the scale of 1 : 16,000,000, there are contained in the same cover four other maps of different parts of the continent, viz Senegal-Niger region; Algeria and Tunis; French Sahara; and Central Africa, Upper Nile and Congo region. These maps, somewhat roughly executed, are coloured to show territorial possessions and spheres of influence, but the Transvaal and Orange River Colony are shown as independent states. The maps are on larger scales than those of most general atlases. Other parts will be published later.

Africa. **Service Géographique de l'Armée, Paris.**

Carte d'Afrique. Scale 1: 2,000,000 or 31·6 stat. miles to an inch. Sheet: 8, Le Caire. Service Géographique de l'Armée, Paris. *Price* 1 *fr.*

This sheet is a new edition revised and corrected up to 1901. Situated as it is at the extreme north-east corner, it serves well to show the great distortion in the configuration of the land produced by using the orthographic projection, which was, for some remarkable reason, chosen for this map. There are inset plans of Alexandria, Cairo, Port Said, Suez, and Ismailia.

Somaliland. **Intelligence Division, War Office.**

Map of a portion of Somaliland. Scale 1 : 1,000,000 or 15·7 stat. miles to an inch. London: Intelligence Division, War Office, 1902. *Price* 3*s*. *Presented by the Director-General of Mobilization and Military Intelligence.*

This map has been prepared in connection with the present military operations in Somaliland, and consists of parts of sheets 68 N.W., 69 N.E., 80 S.W., 81 S.E. of the Intelligence Division 1 : 1,000,000 map of Africa. It includes the region from Berbera on the north to just below Bari on the Webi Shebeli on the south, and from Hargeisa on the west to the meridian of 50° 30′ E. on the east.

Somaliland. **Stanford.**

Map of the British Somali Coast Protectorate. Scale 1 : 1,000,000 or 15·7 stat. miles to an inch. London: Edward Stanford, 1902. *Price* 5*s*. *Presented by the Publisher.*

Includes the region between 6° and 11° 40′ N. lat. and 42° 20′ and 50° E. long. It thus shows British Somaliland, the Ogaden country, and a part of the Italian protectorate on the east coast, and will serve to illustrate the scene of the present military operations.

Tunis. **Service Géographique de l'Armée, Paris**

Tunisie. Scale 1 : 100,000 or 1·5 stat. mile to an inch. Sheet No. XXV., Jana. Paris: Service Géographique de l'Armée. *Price* 1.20 *fr.*

AMERICA.

Canada. **Turnbull.**

Map showing exploration between Lakes Winnipeg, Manitoba, and Winnipegosis. Scale 1 : 380,160 or 6 stat. miles to an inch. To accompany the report of Thos. Turnbull, D.L.S., dated February 9, 1901, in the 'Annual Report of the Department of the Interior for 1901.' Ottawa, 1901. *Presented by the Surveyor-General of Canada.*

Canada. **White-Fraser and Saint Cyr.**

Map of the Country adjacent to the 60th parallel of latitude from Teslin lake to Alsek river. Scale 1 : 380,160 or 6 stat. miles to an inch. To accompany reports of George White-Fraser, and Arthur Saint Cyr, in the 'Annual Report of the Department of the Interior for 1901.' Ottawa, 1901. *Presented by the Surveyor-General of Canada.*

Guatemala. **Bureau of the American Republics, Washington.**

Guatemala from official and other sources. Prepared in the Bureau of the American Republics. William Woodville Rockhill, Director. Compiled and drawn by M. Hendges. Scale 1 : 792,000 or 15·2 stat. miles to an inch. Washington, D.C., 1902. *Presented by Colonel G. E. Church.*

A useful general map of Guatemala, indicating in red letters the approximate location of twenty-two different minerals throughout the country. A good deal of other information concerning ports, means of communication, lights, etc., is given.

Paraguay. **Idiaquez.**

Mapa de la frontera con el Paraguay. Formado por Eduardo Idiaquez, Ing. de Limites. Scale 1 : 2,900,000 or 45·7 stat. miles to an inch. La Paz: La Direccion de Limites, 1902. *Presented by the Oficina Nacional de Inmigracion, Estadistica, La Paz.*

This map includes the region of the Gran Chaco, lying between the Pilcomayo and Paraguay rivers, and shows in various symbols the various boundaries between Bolivia and Paraguay according to the claims of the two countries and different treaties. A clear explanation is given of the various signs employed to indicate the different lines. The routes of the expeditions of Dr. Campos and A. Thouar are also given.

United States. **Rand, McNally & Co.**

Indexed County and Township Pocket Map of Minnesota. Scale 1 : 1,013,760 or 16 stat. miles to an inch. New edition, 1902. *Price* $0.25.—Vest Pocket Map of Michigan. Northern: Scale 1 : 1,013,760 or 16 stat. miles to an inch; Southern: Scale 1 : 760,320 or 12 stat. miles to an inch. *Price* $0.15 *each.* Chicago and New York: Rand, McNally & Co., 1902. *Presented by the Publishers.*

ATLANTIC OCEAN.

Atlantic Ocean. **Neumayer.**

Deutsche Seewarte. Atlantischer Ozean. Ein Atlas von 39 Karten, die physikalischen Verhältnisse und die Verkehrs-Strassen darstellend, mit einer erläuternden Einleitung und als Beilage zum Segelhandbuch für den Atlantischen Ozean. Zweite Auflage. Herausgegeben von der Direktion. Hamburg: L. Friederichsen & Co., 1902. *Presented by Prof. G. Neumayer.*

POLAR REGIONS.

North Polar Region. **Isachsen.**

Übersichtsskizze der von der Norwegischen Fram-Expedition 1898–1902, erforschten Polargebiete. Von Gunnar Isachsen. Scale 1 : 6,000,000 or 94·6 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang, 1902. Taf. 21. Gotha: Justus Perthes. *Presented by the Publishers.*

GENERAL

Ancient Geography. **Kiepert.**

Formæ Orbis Antiqui. 36 Karten im Format von 52 : 64 cm. mit Kritischen Text und Quellenangabe zu jeder Karte. No. xxiii. Italia Superior cum Regionibus Alpinis. Mit. 11 Seiten Text. Ergänzt und herausgegeben von Richard Kiepert. Berlin: Dietrich Reimer (Ernst Vohsen), 1902. *Price 3 marks.*

The present part of this atlas of ancient geography contains Sheet xxiii., Northern Italy and the adjacent Alpine countries, with eleven pages of letterpress, descriptive and critical, which gives also the authorities consulted in the construction of the maps. There are now altogether nine sheets published out of the thirty-six of which the complete atlas will consist when finished.

German Colonies. **Sprigade and Moisel**

Grosser Deutscher Kolonialatlas. Bearbeitet von Paul Sprigade und Max Moisel. Herausgegeben von der Kolonial-Abtheilung des Auswärtigen Amts Lieferung 2. Die deutschen Besitzungen im Stillen Ocean und Kiautschou. Berlin: Dietrich Reimer (Ernst Vohsen), 1902. *Presented by the Publisher.*

The first part of this atlas of the German colonies was published in 1902, and noticed in the *Geographical Journal* for January, 1902. This second part contains the following maps: No. 26, German New Guinea (western sheet); No. 27, German New Guinea (eastern sheet); No. 28, The Ladrones and Marshall Islands. The first two are on the scale of 1 : 2,000,000, and the third on that of 1 : 3,000,000. After the map is an index to the names on the map of the Kameruns, which appeared in the first part. The maps are well drawn and printed in colours. Insets are given on enlarged scales of important bays and harbours.

World. **Bureau International des Administrations Telegraphiques, Bern.**

Carte des Communications Télégraphiques due Régime Extra-Européen, dressée d'après des documents officiels par le Bureau International des Administrations Télégraphiques. Scale 1 : 20,997,504 or 331·4 stat. miles to an inch. 4 Sheets. Bern: Bureau International des Administrations Telegraphiques, Bern, 1902.

This is a map of the World on Mercator's projection, in four sheets, each measuring

$17\frac{1}{4} \times 28\frac{3}{4}$ inches, upon which the telegraph lines, both overland and submarine, are shown in black. Boundaries of the various countries are shown in red, and the water is tinted blue.

World. **Rinaudo.**

Prof. Costanzo Rinaudo. Atlante Storico per el Scuole Secondarie. Parte Prima. Il Mondo Antico. 19 Carte e Repertorio di titti i nomi. Disegni di Domenico Locchi. Turin: G. B. Paravia & Co., 1902. *Presented by the Publishers.*

This is the first part of a little general atlas specially prepared for the use of Italian secondary schools. It contains nineteen maps and plans dealing with ancient geography. These have been drawn by Domenico Locchi from reliable authorities, and printed in colours. They are accompanied by letterpress and an alphabetical index to place-names.

World. **Stieler.**

Neue, neunte Lieferungs-Ausgabe von Stieler's Hand-Atlas, 100 Karten in Kupferstich. 11, 12, 13, and 14 Lieferung. Gotha: Justus Perthes. *Price 60 pf. each part.*

Parts 11 and 12 (in one) contain: No. 42, South Scandinavia, 1:2,500,000, by C. Scherrer; No. 79, S.W. sheet of a four-sheet map of Australia in four sheets, 1:5,000,000, by Dr. H. Haack; Nos. 88 and 90, United States, sheets 3 and 5. 1:3,700,000, by H. Habenicht.—Parts 13 and 14 (in one): No. 13, Thuringian States, 1:500,000, by C. Scherrer and O. Koffmahn; No. 65, Japan, Korea, and Eastern China, 1:7,500,000, by C. Barich; Nos. 87 and 89, United States, sheets 2 and 4, 1:3,700,000, by H. Habenicht.

CHARTS.

North Atlantic Ocean and Mediterranean Sea. **Meteorological Office, London.**

Pilot Chart of the North Atlantic and Mediterranean for January, 1903. London: Meteorological Office. *Price 6d. Presented by the Meteorological Office, London.*

United States Charts. **United States Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for December, 1902; and of the North Pacific Ocean for January, 1903. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Burma, Siam, etc. **Rigby and Armstrong.**

Eighty-four photographs taken during a journey in 1899–1900 from Moulmein to Hanoi by Captains Rigby and Armstrong. *Presented by Captain G. C. Rigby.*

The route followed by Captains Rigby and Armstrong, during which these photographs were taken, was from Moulmein to Pupun, thence to Mong Haut, in Siam, crossing the Selwin at Dagwin Ferry, and on to Cheng-hai; hence to Ssumao, in south Yunnan, Puerh, Mong Lieh, Manhao, on the Red river, Mong-tsu, Kai-hua fu, Hagiang, and thence on to Hanoi in Tongking. A great part of the country traversed is very imperfectly known, and the photographs, though small, are thus important.

(1) On the Yonzalin river, Burma; (2) Unloading the elephants on the banks of the Salwin river, Dagwin ferry; (3) South gate of Mainglungyi, Siam; (4 and 5) Elephant transport: a bad bit of road between Mainglungyi and Mong-haut; (6) On the Meping river, Siam; (7) Siamese boats, Meping river; (8) Irrigation water-wheel, Meping river; (9) A Siamese "Wût," or temple; (10) Camp at Mechali: a rest-house; (11) Laos on the march; (12) House of Dr. Denman (American missionary), Cheng-hai; (13) Miaotsu people at Cheng-hai; (14) Natives of Ta-si-lek village in S. Shan State of Keng-tung; (15) Akkos at Mong-lin, S. Shan States; (16) Akko girl, Monglin; (17 and 18) Leu women, Mong-Yawn; (19) Mekong river, near Paliao, S. Shan States; (20) At Mong-Yawn fair; (21) A jungle camp; (22) View down Mekong river, near Mongham ferry; (23) Shan girls on trek; (24) The Panthai mule-saddle; (25) A midday halt; (26) "Wût" at Tapun in Keng-hung, Chinese Shan States; (27) A Keng-hung village; (28) Shan women; (29) Shan Talôk women; (30) Camp at Tu-ko-Chai in hills south of Ssumao; (31) Puteng valley, south of Ssumao; (32) Chinese Imperial Customs building, Ssumao; (33) West gate of Ssumao; (34) South gate and street, Ssumao; (35) Cotton caravan outside the custom-house, Ssumao; (36) The "Ting" (magistrate) of Ssumao returning from a visit to the custom-house; (37)

Market, Ssumao; (38) Street and roofs in Ssumao; (39) Shans at the market, Ssumao; (40) Hill people near Ssumao; (41) A refreshment stall in the market, Ssumao; (42) Main street, Ssumao; (43) Spring procession, Ssumao (soldiers); (44 and 47) Spring procession; (45) Spring procession, soldiers and bannermen; (46) The "Ting" of Ssumao in spring procession; (48 and 52) Procession of the gods, Ssumao, takes place annually in January; (49) A car in the procession of the gods; (50) A car supporting little boys dressed up as angels; (51) Some of the gods; (53) Soldiers in procession of the gods; (54) Procession of gods: car with angels; (55) God of war in procession; (56) Paddy-fields, Nakoli; (57) Bridge on road from Ssumao to Puerh; (58) Terraced paddy-fields, Mong-hsien; (59) Nape valley; (60) A valley on the Puerh—Mong-lieh route; (61) Man-pung-tien valley; (62) Mong-lieh valley; (63) Mong-lieh village; (64) On the road to Chi-ma-pa; (65) Our escort from Mong-lieh; (66) A Chi-ma-pa girl; (67) Automatic grain-husker worked by water; (68) Terraced paddy-field; (69) Apachai women; (70) Wuni women; (71) Manhao on Red river; (72) A Shan-chai valley; (73) Rocky country above Yaoto; (74) Native of S. Yunnan; (75) On the road to Matang; (76) Rocky country on road to A-la-shu; (77) Temple on road to Kai-hua-fu; (78) On the road near Kai-hua-fu; (79) The Clear river near Kai-hua-fu; (80) Bridge on road to Sinkai, S. Yunnan; (81) Street Shue-li-kai; (82) Chinese in Shue-li-kai; (83) Ma-li-po; (84) My Chinese interpreter.

Faröe Islands. **Hepburn.**

One hundred photographs of the Faröe Islands, taken by David Hepburn, Esq., 1901–1902. *Presented by David Hepburn, Esq.*

These photographs have been selected from a large number taken during two visits to the Faröe Islands in 1901–1902. Considering the frequency of sea-fogs and general unfavourable meteorological conditions which prevailed at the time of his visits, Mr. Hepburn may be congratulated upon the results he has obtained, many of the photographs being extremely good. They are platinotype prints. The titles are as follows:—

Stromö island:—(1) Thorshavn, the capital; (2) South harbour, Thorshavn; (3) The bridge, Thorshavn; (4) The hotel, Thorshavn; (5) Fishing-boats, Thorshavn; (6) Landing-stage, Thorshavn; (7) Whale's jaw gate, Thorshavn; (8 and 9) Streets, Thorshavn; (10) A fisherman's funeral, Thorshavn; (11) The doctor's house and pony, Thorshavn; (12) Evening, Thorshavn; (13) The outskirts of Thorshavn; (14) The Kongebroc, Thorshavn; (15) The British Consulate; (16) The British Consul in his boat; (17–19) The north harbour, Thorshavn; (20) Frudriks vaag, Thorshavn; (21) A group of boys and pony, Thorshavn; (22) King Oscar's monument, Thorshavn; (23) Wool drying in a street, Thorshavn; (24) The Skerry rocks off Hoyvig; (25) Vestmanhavn, Whale bay; (26) Coast at Hoyvig; (27) Bird Cliffs at Nordordahl; (28) Cairn on road to Velbistad; (29) Kalback church; (30) River near Kalbak; (31) The coast near Thorshavn; (32) The fort, Thorshavn; (33) Saudegjerde river; (34) Saudegjerde river lower down; (35) Soudegjerde river near mouth; (36) Distant view of the island of Kolter; (37) Faröese boy; (38) Women carrying peat; (39) Faröese boys; (41) A peat-gatherer; (42) Photograph from model of Faröese boat; (43) Faröese boatmen; (44) Faröese fisherfolk; (45) Faröese children; (46) Woman dyeing cloth; (47) Cleaning fish; (48) Farm Kirkebö; (49 and 50) Ruins of monastery, Kirkebo; (51) Ancient log house, Kirkebo; (52) Boat houses, Kirkebo; (53) Going to church, Kirkebo; (54) The church, Kirkebo; (55) Farm house and church gate, Kirkebo; (56) A Faröese from Kirkebo; (57) The trading steamer *Smirel*; (58) The whaler *Selvik*; (59) On board the *Selvik*; (60) Harpoon gun of the *Selvik*; (61) Kollefiord; (62) A haul of Seythe; (63) Drying fish on housetops; (64) Drying fish on rocks; (65) Stacking fish; (66) Cutting up whale flesh. Syderö island:—(67) Women carrying fish, Trangjisvaag; (68) Fish drying on rocks, Trangjisvaag; (69) Rocks above Trangjisvaag; (70) Cave at Trodboe, near Trangisjvaag. Österö island:—(71) Skjaale; (72) Strender, disembarking pony; (73) Landing at Funding; (74) A Faröese on bridge near Funding; (75) Funding Fiord from Slettaratinde; (76) On the slopes of Slettaratinde; (77) The summit of Slettaratinde; (78) On the summit of Slettaratinde; (79 and 80) Neighbouring peaks, from Slettaratinde; (81) Lake above Eide, from Slettaratinde; (82) Slettaratinde (summit not in view); (83) Eide; (84) Leaving Eide. Nolsö:—(85) Southern extremity of Nolsö; (86) The "eye of the needle," natural arch; (87) Haymaking; (88) Nolsö Eide; (89) Boat and crew entering a cave; (90) Nolsö. Vaagö Island:—(91) Midvaag, Whale bay; (92) The "Witch's Finger;" (93) The "Witch's Finger," front view; (94) The base of the "Witch's Finger." Bordo island:—(95) Rocks above Klaksvig; (96) Pinnacle near the summit of Klak; (97) From Klak, looking south; (98) Kalsö fiord, from Klak. Kalsö island:—(99) Mydledal; (100) Northern extremity of Kalsö, from sketch.

Persia. **Witherby.**

Thirty-six photographs of South-Western Persia, taken by H. F. Witherby, Esq. *Presented by H. F. Witherby, Esq.*

These photographs were taken by Mr. Witherby during his journeys between Bushire and Shiraz. He has divided them into three sections, the first, Nos. 1 to 11, illustrating the country traversed from Bushire to Shiraz; the second, Nos. 12 to 29, the return journey to Bushire, which was by a different route, and the third, Nos. 30 to 36, photographs of the inhabitants. The following is a list of the titles:—

(1) Landing from ship at Bushire; (2) Bridge over the Daliki river between Bushire and Shiraz; (3) Mian Kotal; (4) Kotal Pei-i-Zun, between Bushire and Shiraz; (5) An Iliyat camp, from Shahpur Shahr; (6) Dasht-i-Bam; (7) Camp in the Dasht-i-Bam; (8) An oak tree in the Dasht-i-Bam; (9) Northern end of Dasht-i-Bam, near Naksh-i-Bahram; (10) Shul river, Tang-i-Giro; (11) View over the Tang-i-Giro; (12) Iliyat camp near Aliabad, near Ardakun; (13) Ardakun, north-west of Shiraz; (14) Camp between Ardakun and Kuh-i-Dinar; (15) On the way to Kuh-i-Dinar from Ardakan; (16) Kuh-i-Dinar from the east side, Iliyats in foreground; (17) Kuh-i-Dinar from the east; (18) Gardan-i-Bijan, the pass over the Kuh-i-Dinar; (19) A piece of the track over Kuh-i-Dinar; (20) A snow-slope on east side of Gardan-i-Bijan, (21) Kuh-i-Dinar from near Sisakht, on its western slope; (22) View to south-east near Sisakt, on west side of Kuh-i-Dinar; (23) Iliyats travelling over the Gardan-i-Bijan, Kuh-i-Dinar; (24) Kuh-i-Dinar from the west; (25) Near Sisakt; (26) Khersun river, west side of Kuh-i-Dinar; (27) In the oak woods on western side of Kuh-i-Dinar; (28) "Tang," near Bijo, south-west of Kuh-i-Dinar; (29) At the bottom of a "tang" near Bijo; (30) Thrashed corn near Nurabad; (31) Shikari with old gun with cudgel-shaped stock near Basht; (32) Tent of Abdullah Khan, chief of Farsi Medun Iliyats, in Po Dinar; (33) Visitors near Naksh-i-Bahram, Dasht-i-Bam; (34 and 36) Dolatiori Iliyats at Bijo, near Basht; (35) A typical Iliyat.

Upper Nile. **Crispin.**

Eighteen photographs of the Nuer Country, and the Sudd of the White Nile. By E. S. Crispin, Esq., M.R.C.S., L.R.C.P. *Presented by E. S. Crispin, Esq., M.R.C.S., L.R.C.P.*

Dr. Crispin's photographs form an interesting little set, both as illustrating the types of natives and the remarkable sudd blocks, which have for so long impeded navigation on the upper Nile and its tributaries. The following are the titles:—

(1) Shilluks in dug-out canoe, Sobat river; (2) Dinka dance, Gobjak, on the Sobat river; (3) Shol-Ajik; (4) Two fine bullocks belonging to Nuers; (5) Tusks and pyramid at Keik; (6) Denkur's capital, Keik, pyramid in centre; (7) Bugler, 10th Sudanese; (8) Detachment of 10th Sudanese at Shitt; (9) A general view of newly opened channel through sudd, with small sudd across it; (10) Camp on piece of true river-bank in the sudd; (11) Men landing from the bows of the steamer on to a sudd-block with its top growth of papyrus; (12) Men on sudd-block clearing the top growth; (13) Top growth cut down and sudd-block cut into sections; (14) Steamer towing out block of sudd, men standing round and holding the hawser in position; (15) Steamer towing out sudd-block; (16) Block towed out into open water, much diminished in size during its journey, partly by compression and partly by the front edge rolling under; (17) Sudd-block let go in open water, floating down stream; (18) Camp on hard ground in sudd.

Vladivostock. ———

Panorama of Vladivostok harbour and town. *Presented by Captain F. C. Mullan.*

This panorama is in five parts, each of which consists of a very clear print from a full-size plate. It is the production of a local Russian photographer.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

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THREE YEARS' EXPLORATION IN CENTRAL ASIA, 1899-1902.*

By Dr. SVEN HEDIN.

It was on June 24, 1899, that I left Stockholm for the fourth time in quest of new experiences and new adventures in the heart of Central Asia. That journey, which occupied a period of three years and three days, is now happily concluded. And to-night I have the pleasure and privilege of laying before you an account of my various journeyings in the centre of the great continent which I have just mentioned.

My preparations for this my last journey resulted in a rather ponderous, but certainly more complete, outfit than I had carried with me in any of my previous expeditions.† Still I had no reason to complain on this score, since, through the courtesy of his Imperial Majesty the Czar of Russia, I was granted full exemption from customs duties, as well as free travelling and free transport through the length and breadth of his empire. The same monarch also gave me an escort of four Cossacks, fine, honest fellows, who, for their loyalty and courage, were, at the close of their term of service, rewarded with gold medals by both his Majesty the King of Sweden and his Imperial Majesty the Czar.

For the journey through the Trans-Caspian region I had the honour of a railway carriage all to myself, the last on the train, so that, from the platform in its rear, I was able to enjoy an uninterrupted bird's-eye

* Map, p. 348. This is simply a provisional sketch-map to show Dr. Hedin's routes It is hoped that a finished map embodying Dr. Hedin's discoveries will be ready for publication before the end of the year.

† The means for undertaking this journey were chiefly given by H.M. the King of Sweden and Norway and some Swedish gentlemen, among others Emanuel Nobel.

view of the country we were travelling through. After that I journeyed by a well-known route from Osh to Kashgar. At Kashgar I raised and equipped a caravan of fifteen camels and ten horses, and with them marched to Lailik on the Yarkand-daria.

I had already crossed Eastern Turkestan in almost every direction, and the river was the only route with which I was not acquainted. Consequently, I decided to make its muddy waters carry me down to the region of Lob-Nor. As being the best suited for my purpose, I bought an ordinary ferry-boat, one of the kind which is ordinarily employed for ferrying goods across the river at those points where it is intersected by the caravan routes, and fitted it up as a comfortable floating house, which became my dwelling-place for many long months. This led to a regular workshop being established in the middle of the desert, carpenters and smiths being sent for from Yarkand to make such alterations in the craft as were necessary. I had a deck fitted over the fore part, and upon that set up my tent. Its interior was fitted up as a study, a writing-table, made out of a couple of boxes, being placed at the entrance. From that vantage-ground I commanded a complete view of the river during the whole of my journey of over 1300 miles. Not a single bend, or lagoon, or sandhill, or grove of trees escaped my observation; all were successively plotted on my maps as we glided on past them one after the other. Amidships I had a hut erected of planks and black rugs, to serve as a photographic dark-room. It was provided with tables and benches, while a barrel was placed on the roof to supply water to the samovar, in which I washed my photographic plates. My baggage was stacked in the stern of the boat, and there also my servants established their quarters. In the same part of the boat they built a small fireplace of bricks, on which they cooked their food throughout the journey; while in the cool autumn evenings they kept a fire burning constantly. A smaller ferry-boat was fitted up as our larder, or store-room. On it we kept our supplies of flour and rice, grapes, melons and pears, vegetables, live sheep and fowls; and these last had a very great deal of cackling to do before they got accustomed to their floating home. When everything was finished, however, the boat was exceedingly comfortable, being, as it were, a sort of country house set afloat on the bosom of the great river. I also had my dogs on board, and a small English collapsible boat, which I used for short reconnoitring trips up and down the stream.

The day before I started I invited the entire population of the district to a big entertainment, at which tea and hot rice-pudding were supplied *ad lib.* The very same musicians who celebrated my departure on my disastrous desert journey of 1895 came again, and twanged their strings in the same melancholy manner. And while their doleful strains fretted the stillness of the night, a couple of barefooted girls whirled round and round in a dizzy dance. But the latter, upon being

photographed the next day under the piercing rays of the sun, did not appear to anything like the same advantage as they did in the light of a Chinese paper-lantern!

On September 17, the caravan, led by the two Cossacks Sirkin and Chernoff, started to follow the land-route *viâ* Aksu and Korla to the rendezvous agreed upon on the Lower Tarim. With me in the boat I took my former faithful servant, Islam Bai, and five boatmen, whom I stationed with long poles one at each corner of the boat, as well as one on the provision boat, directing them to keep the flotilla from sticking fast in the bank should the current carry us too violently up against it.

When all was ready I gave the signal for the start. Our boats made their way up-stream, and the hospitable shores of Lailik were speedily lost to view behind the woods. Here began a most idyllic journey. It was indeed a pleasure to live on the river, and study its pulsating life, its ebb and its flow, its capricious windings, its ever-changing shores. To me, who had been accustomed to travel on horseback, or to survey the country from the back of a swaying camel, there was an incomparable enjoyment in feeling myself carried smoothly along by the current of a peacefully flowing river; and in sitting still all the time at my writing-table, while the landscape came, as it were, to meet me, and unfolded itself before my eyes like a perpetually changing panorama, so that all I had to do was to study and observe it from the vantage-ground of my seat in the stalls. And it was, too, a delightful feeling to be always at home, and carry my house about with me, as a snail does, through the interior of Asia. When the weather was warm, I had only to throw off my clothes and jump straight in from my writing-table. Then, later on, dinner would be served amongst my compasses, field-glasses, and levelling instruments. My meteorological observatory was on the roof of the hut, and in it were my barometer, which recorded daily how we slowly but gradually descended, and my thermometers, which gradually sank lower and lower as the autumn advanced.

We had only gone a very short distance when we managed to run aground. But the boatmen leapt into the water and pushed the boat off again. After that I sent the smaller provision boat on in front, to act as a pilot, and warn us of the presence of dangerous places.

I wonder how many scores of times we got stuck on sandbanks during that journey? As a rule, we camped among the woods on shore, where there was plenty of fuel. But while the crew slept on land, I slept on board. Every evening after we landed, I measured the volume of the river, with the help of my collapsible boat, a velocity instrument, a sounding-pole, and a rope stretched across the stream. During the first few days the volume worked out at the rate of 3355 cubic feet per second.

At Kotteklik we descended certain rapids, which our craft shot in

splendid style, without the slightest trouble. But below the rapids the force of the current was so strong that we were unable to keep clear of the banks, and my writing-table was in great danger of going overboard.

Further on the river divided, and we drifted in amongst arms so narrow that we were only just able to force the boat along them. In other parts the stream was encumbered with driftwood; and the trunks of the poplar trees, which lay submerged at the water's edge, were not noticed until the boat swung right round upon them. At one point, where large quantities of water are drained off to feed the irrigation canals of Maral-bashi, the current dwindled to 810 cubic feet in the second, and we were obliged to requisition the natives to help in hauling our boats over the shallows. After that the country became uninhabited; and the boats glided noiselessly through the dense forests, which were often so thick that scarce a ray of sunlight pierced through to the dark hiding-places and holes in which the wild boars, tigers, and other beasts of the jungle make their lairs.

At the beginning of our journey the gnats were very troublesome, but the frosty weather soon put them to flight. At the same time the poplars put on their robes of cloth of gold, as if preparing for an autumn carnival. Tall and straight they stood, solemnly mirroring their heads in the great river, the Alma-Mater, of East Turkestan, as though they were religiously paying their devotions to her, just as the Brahmins and grey-haired pilgrims who journey to Benares to die pay reverent homage to the Ganges.

In this way we glided on day after day, week after week, down the dark waters of the Tarim, through the enchanted forests, which shut it in, as it were, along a kind of Venetian thoroughfare lined by palaces magically changed into trees, and by quays of golden shimmering reeds. When the current flowed more slowly, the boatmen nodded in turns over their punting-poles. And when the wind blew through the forest, it scattered a shower of golden leaves over the face of the river, making a golden waterway for us all through the autumn, as we followed every curve and winding of the stream. It was as though we were threading enchanted sargasso seas!

As a rule, the Tarim is very sinuous. For instance, in one case, after making a detour of over three-quarters of a mile, we found we had only advanced 200 yards in a lineal direction, or, in other words, had gone round eight-ninths of a circle in order to get over a distance equal to the remaining ninth. In this way it occasionally happened that we came back to the very same poplars which we had left behind us a few hours previously.

Upon reaching Masar-tagh I stayed there two or three days, and carried out several excursions by boat and on foot, with the view of completing the maps I made on my previous journey. The temperature sank for the first time below zero, that is to say, to

30° Fahr., on the night of October 12. On the evening of October 17 we were cheered by the sight of a fire blazing amongst the trees on the bank. It was made by shepherds, who were in this way seeking to scare away the tigers. As soon as they caught sight of our boat, with its spectre-like tent and its coal-black hut, gliding noiselessly between the river-banks, they took incontinently to their heels, and fled, leaving both sheep and fire to their fate. Throughout the whole of the journey we had the greatest difficulty in getting into communication with the half-wild shepherds, who pasture their flocks in the primeval forests of the Tarim. No matter how we called to them, they steadfastly refused to come and talk with us; but, at the sight of our boat, they nearly always fled away like frightened antelopes, and it was only by the exercise of little stratagems that we were able to secure them at all, and detain them on board until their local topographical knowledge came to an end.

The first break or interlude in our monotonous journey occurred when we approached the inhabited region of Arvat. We were met by several begs, or chiefs, and a crowd of horsemen, amongst whom were eight falconers, each carrying his bird on his glove. These people accompanied us along the banks, and never have the waters of the Tarim witnessed a more festive procession.

As the autumn advanced, we saw, both day and night, huge flocks of wild geese flying overhead, making for India by way of Yarkand. They kept regularly at an altitude of 600 or 700 feet above our heads, and the air echoed again with their discordant quackings. Unerringly they find their way along their aerial highways—those wonderful feathered pilgrims, as surely as the rivulets from the melting glaciers find their way down to Lob-nor. And truly a majestic sight it is to stand and watch them streaming onwards in their serried phalanxes, like squadrons of the sky charging on and on, on silent and untiring wings.

At length we arrived at the mouth of the Ak-su-daria, and there our river met with a very noteworthy augmentation of its volume. The rate of flow of the current quickened up to nearly $2\frac{1}{4}$ miles an hour, and our boat swung right round as we glided out into the swirl of the confluence. But all went excellently well; the banks disappeared rapidly behind us, while every now and again the river was broken by rapids. For two days we travelled at the rate of $3\frac{3}{4}$ miles an hour, and consequently had to keep a sharp look-out as we raced past the woods and the *kamish* (reed) beds, at the risk of being submerged beneath the avalanche of a crumbling bank of sand. As the season grew older, it began to be sensibly cold on board. On the night of November 14 both boats froze fast in the ice, though, fortunately, it was thin, and by the end of the month the temperature had sunk 29° below freezing-point (Fahr. scale). On one occasion we had quite a dangerous adventure —our boat was carried close up underneath a high, steep bank, and a

little way ahead of us we saw a poplar tree leaning out low down over the current. The punting-poles failed to touch the bottom, and my tent and every other structure on board would infallibly have gone over the side had not one of my men, in the nick of time, jumped into the ice-cold water and swum to land with a rope.

And now we began to live in daily expectation of the river freezing, for sooner or later the ice would raise an insurmountable obstacle to our further progress. Hence there began a sort of race between ourselves and it. Could we manage to get as far as our rendezvous before it came and stopped us? For several days we journeyed all day long, and often far on into the night; and for a period of ten days towards the end of November we met with rare good fortune. Some years ago the river made for itself a new bed through a sea of sand, which flung up its dunes like pyramids on either bank. This new channel gave us a short cut. But not a vestige of vegetation, not an antelope, not a human being, not even so much as a raven or a vulture, gladdened our eyes on these dream-like, desolate banks. Here again the speed of the current was over 3½ miles an hour, so that we sped on at a breathless pace past the sandhills, which towered up fully 350 feet above the surface of the stream.

At last it froze so hard at night that we had to chop out our boats with axes every morning. A white chain of drift-ice was trailed down the river, and jangled like a string of bells against the sides of our boats at night. During the first days of December the river grew full of ice of this description, and most fantastic were the shapes it assumed on those evenings when we continued our journey far on into the darkness. At such times our boats were preceded by small native canoes, carrying flaring oil-lamps. These constantly moving ice-bound channels gave out an unceasing succession of groans and moans; and when we became embedded in them, and were carried along at the same rate as they moved, they appeared to be relatively stationary—that is to say, we appeared to stand still, though the slow movements of the compass-needle revealed to us the windings of the river, while the dim-lit banks glided past us like wandering spectres. At last, however, the ice won the upper hand. The strips of ice along the banks fastened themselves to the sides and began to grow inwards towards each other, so that the channel of open water in the middle of the river became narrower and narrower. On December 7 the ice welded the two sides of the river together. We were frozen fast, and had to go into winter quarters. The place where this happened was called Yanghi-koll, and here, by a stroke of good luck, we fell in that very same day with our caravan. Then arose, as if by magic, a small town on the desolate banks of the Tarim. Tents were pitched, *kamish* (reed) huts constructed, and stables built to shelter the animals of the caravan. In the market-place we kept burning at night a Chinese lantern swung on a pole, and this was

the only lamp-post in the whole place. At this time, also, we kindled a fire, which was not allowed to go out until the end of May in the following year. Traders came to visit us from Korla and from Kuchar, and desired to barter their wares with us; in this way a lively market flourished in the wilderness.

After making an excursion into the interior of the sandy desert, and entertaining the famous French traveller Bonin, on his way from Peking, in my open-air camp, I set out on December 20 from Yanghi-koll with a caravan of seven camels, one horse, four men, and two dogs, to cross the most appalling desert on the face of all the earth, the Takla-makan, my object being to strike the town of Tatran, on the Cherchen-daria, on the other side of the desert. That meant a journey of close upon 180 miles, or twice the distance I traversed in 1895 in another part of the same desert, in the course of which the whole of my caravan perished except one man. But now it was the depth of winter, and I loaded four of the camels with blocks of ice, while two others carried fuel, and the seventh our provisions and furs. As we had no tents with us, I slept the whole of that winter in the open air, although the temperature fell 27½° below zero. As we had to husband the camels' strength, I took with us for the first two days a small reserve caravan of two men and three camels, the latter carrying ice and fuel; but on Christmas Eve I sent them back.

When we set out from our camp, the inhabitants of the district looked upon us as suicides; and both I and Islam Bai knew only too well how dangerous the journey was. The desert opened out before us like an illimitable sea, and ere two days had passed we became lost in its endless labyrinths of sand. Their conformation, however, lent us great assistance in our march. The prevailing winds blow from the east, and heap up the sand in ridges like gigantic waves, or pile it up in vast accumulations of dunes 300 to 400 feet high. These on the sheltered side go down at an angle of 33°; but on the windward side, or the east, they have a gradual slope. But in addition to these north-and-south ridges there is also another system of sand-dunes disposed at right angles to the first, that is, in lines running from east to west. These have been built up by winds blowing from the north and from the south during the winter.

The sand-dunes thus form a kind of network; and within the meshes there exist depressions which are often perfectly flat, and show the clay-soil underneath, swept free from sand. These spots the natives call "bayir." It is in depressions of this character that we find the chain of unnumbered lakes, which accompany the right bank of the Tarim throughout its course.

Other circumstances of an unexpected nature also conspired to the successful issue of our enterprise. In the middle of the desert we chanced upon some plots of *kamish* (reeds); consequently the journey

cost us no more than one camel. The remainder of the troop stood the journey well, as they swayed backwards and forwards like ships ploughing over the waves of the desert. The worst evil we had to contend against were the incessant storms, which whirled up the sand in front of us, so that we were quite unable to see any distance on ahead. A semi-darkness prevailed the whole of the time; and no sooner had we left the small *kamish* oases behind us, than we were again lost in the labyrinthine network of sand-dunes. To make things worse, the hard clay depressions now disappeared. If there exist sand deserts on the moon, I do not think they can possibly be more desolate than the Takla-makan.

We had also to exercise the strictest economy with our fuel; only a certain number of sticks were allowed to be doled out every evening. Hence we had to wrap ourselves up in our furs and crouch close together round the fire to keep ourselves warm; while I jotted down my notes by the light of a single wretched lantern. We were also obliged to be sparing with our ice. Yet, even though this had failed us, the heavens were kind, for, in the beginning of January, they took care that we should not suffer from want of water. For it began to snow, and continued snowing for several days. I used to wake up in the morning completely buried under snow, so that Islam Bai had to set to work and dig me out of my warm lair with a spade. The sandhills disappeared from sight entirely underneath the undulating sheet of snow. To sleep in the open air with 60° of frost is, however, far more interesting than agreeable. When we sat over our camp-fire we often had a temperature of 85° on the side next the fire, but a temperature of 20° below zero on the outer side of the circle.

At last, on January 8, we sighted the first tamarisk trees, and, that same evening, we encamped on the banks of the ice-bound Cherchen-daria. From this point I travelled up-country to a place called Andereh, a distance of 240 miles. Finally, by way of the ancient bed of the Ettek-tarim, now dry, and after that by unknown paths, we reached Yanghi-koll again on February 24. Here I was joined by two Buryats, or Trans-Baikal Cossacks, who had spent four months on the journey from Trans-Baikalia.

On March 5 I was again in the saddle, with my face towards the eastern part of the desert regions, at the head of a new and well rested caravan, made up as follows: the Cossack Chernoff, six Mussulmans, twelve camels, and one horse. My first object was to map the Kum-daria, the dried-up bed of what was formerly an outlet of the Tarim, when that river flowed into the ancient lake of Lob-nor. The upper part of this ancient river-bed is exceptionally well defined, and contains, even at the present day, a few salt-water pools. Further on, however, it is completely dry, and in parts entirely obliterated.

But to return to our journey. One day, in the very middle of our

march, we were overtaken by a sandstorm of such a violent character that the whole caravan was brought to a sudden halt. These storms loom up in the east like a black wall, and swoop down upon you like lightning, so that in an instant everything is swallowed up in an impenetrable fog of reddish yellow sand and dust. Whilst this particular storm was raging I lost touch of my caravan, and spent a considerable time wandering about before I could find it again. We could only get up one half of my tent under the shelter of a sandhill. But the sand rained in through the canvas, and every single object that was lying about became covered with it. Nay, it even gets into your mouth and grits between your teeth. To cook food in such a tempest is of course absolutely out of the question, when the wind is blowing at the rate of 47 miles an hour. A cup of water and a piece of bread was all we could get to eat. The camels lay perfectly still, with their necks stretched out to leeward, and the men tightly muffled up in their coats. There is an amazing force locked up in these desert storms. The quantities of material they lift up and carry away, and deposit in other places, is enormous.

At last we found water at Yardang-bulak, a little well at the foot of the mountain. The well itself was tremendously salt, but the sheets of ice upon it contained fresh water. Wild camels were common in these parts, and we shot a couple.

From this point our route lay along the bed of the Kum-daria, sometimes in the channel itself, sometimes along its bank. Here on three separate occasions we came upon fragments of earthenware, showing that the banks of this river were formerly inhabited, although for centuries the ground has not been moistened with a drop of water. The further we advanced towards the east, the more desolate grew the desert. The poplar trees which stood on the banks of the river-bed were a thousand years old, and as brittle and fragile as glass—the grave-stones, as it were, of the ancient forest.

After this we came to a most remarkable oasis, namely, Altimish-bulak, or the Sixty Wells. Here again we found salt water, with big blocks of ice in close proximity. These salt-wells furnish sustenance to vigorous patches of *kamish* (reeds) and belts of tamarisks, but all huddled together within such a narrow space that it was easy to imagine we had landed upon an islet in the middle of the desert sea. When we were still a considerable distance off, the hunters of my party made out a herd of camels, consisting of an old male and five young animals, grazing amongst the bushes. The caravan came to a halt, and I went with the stalkers for the purpose of examining the creatures through my field-glass. They were barely 100 paces distant, and looked really splendid in their light brown woolly winter coats. Two of them were lying down, the others grazing, whilst the old one was gazing in our direction, as though he suspected danger. Our guide,

Abdu-Rehim, crept stealthily through the bushes like a panther. When he fired, the entire herd took to their heels, and went off in a whirling cloud of dust – all except one, a young and handsome male, whose flesh made a very welcome addition to our larder. The wild camel is certainly a wonderful animal. You find him in the dreariest parts of the desert. He only stays a short time in each oasis, but like a ship on the ocean of the desert, is continually passing backwards and forwards. Nobody knows how he lives. He springs up out of the dried-up earth as if he were a ghost, and vanishes like the wind, and when disturbed in his peaceful haunts does not stop in his wild flight for days and nights together.

Altimish-bulak was an important halting-place; and it was from there I proposed to cross the desert in a southerly direction. The distance to Kara-koshun, where we expected to find game, could be covered in a week, and even if our supply of water did give out, we knew that we were hardly likely to perish of thirst. Amongst other stores we took four sacks filled with ice; but, in spite of our utmost care to protect them from the sun, two pailfuls dripped away during the first day or two of the march. A few steps only away from the wells of Altimish-bulak, and we were again in mid-desert. The contour soon began to fall away gradually in the direction of the old Lob-nor lake, which was indicated by a belt of dead forest. Here we found myriads of Linnæa shells, so that the ground was in many places quite white with them. It was here, too, that Chernoff and Ördek--the latter one of the men I brought with me from Yanghi-koll—discovered the ruins of two or three houses. The beams and other parts of their wooden framework lay scattered about on the ground, half buried under dust and sand. One circumstance which at once lent a considerable antiquity to the buildings was the fact that they stood upon pediments of clay, that is to say, narrow mounds, about 8 feet high, which had been built up to suit the plan of the houses. Originally these clay footings were constructed on the level ground; but the north-east wind, in its restless activity, had scooped out the ground all around them, and swept it clean away. The clearest indications of the enormous erosive power of the wind in these parts exist everywhere throughout the desert, the clay soil being in many places furrowed with trenches 6 to 7 feet in depth in the direction in which the winds blow; and, as a consequence of this, you often appear to be marching amongst benches and tables all made of clay.

We collected specimens of the wood-carving from the houses, and dug up some Chinese coins, besides axes, sacrificial cups, and so-forth. The roof of each house lay piled up on its west side, and under the shelter of the house itself. No doubt it had been hurled there by the last desert storm, which it had been unable to withstand.

But as our water-supply would not allow us to stay more than

twenty-four hours in this place, we were obliged to continue our march southwards, though not until I had photographed the ruins and measured the site.

That evening, just when we were going to dig a well in our new camping-ground, to get water for the camels, we discovered that we had forgotten our spade; it had been left behind in the ruins. And as the spade was an implement of great importance to us, I sent Ördek back to fetch it. Accordingly he started back the next morning, while we continued our march. Not long after this a violent sandstorm came down upon us, and we feared the worst for our solitary traveller. But Ördek's topographical instinct did not fail him. Although he lost our track, he nevertheless succeeded in making his way back to the ruins, and, on his return with the spade, brought with him what was even more important, namely, some fresh wood-carvings, executed with still greater perfection than those we discovered first. Besides that, he also gave me information of such a character that I felt I must at all costs return to these sites of ancient civilization. To do so then was, however, impossible; I had to control my patience until the following winter.

Our supply of water was just on the point of giving out when we at length reached the shore of a completely new lake, which spread out to the north of the marsh of Kara-koshun. It was fed by an equally new branch of the Tarim, which left that river at Shirgeh-chappgan.

We made the return journey in canoes, first up the new branch and then along the Tarim and the network of waterways which make up its delta. The twenty-five days this canoe journey lasted would have been very delightful had it not been for the midges, which tormented us unmercifully every evening.

I now mapped out in detail the lakes which I had discovered on my previous journey, namely, Avullu-koll, Kara-koll, Tayek-koll, Arka-koll, and Chivillik-koll, together with several others which on that occasion escaped my observation. I found that they reached a depth of 30 feet; and in one arm of the river in this same neighbourhood I sounded a depth of 41½ feet, or seven and a half times more than anywhere else in the newly formed marsh of Kara-koshun.

It is indeed a significant fact that the deepest depression of the Lob region is found, not at the termination of the hydrographical system, but here in the region which, from a remote antiquity, has borne the name of Lob.

The 8th of May saw us again at the Yanghi-koll, where we found everything peaceable and well. By this the river had begun to swell from the melting of the ice, and its volume now measured 3400 cubic feet in the second, or about the same as at Lailik, where I began my voyage on its waters.

Next I sent off, under the charge of the Cossack Cherdon, my big

caravan of horses and mules, instructing him to make for Tomirlik, in the Chimen-tagh, and after them the camels, bound for the same place, under Chernoff and Islam Bai. Meanwhile, I myself continued my journey, along with Sirkin and Shagdur, in the big boat, and so finished laying down my maps of the lower Tarim.

Our huts now stood empty and abandoned. The native traders departed in quest of more profitable markets; but as the place needed a name for future identification, it was, consequently, called Tura-sallgan-uy, which means "the houses built by the European." All very nice in its way. But the very next spring-flood that came swept away the whole of our bank of the river; our huts vanished off the face of the earth, and, together with the poplars, were swallowed up in oblivion.

During the course of my journey down the big river, I investigated and sounded many of the peculiar lateral or marginal lakes which lie embedded amongst the dunes of drift-sand immediately along its right bank. They are like growths or parasites, which suck away, as it were, the life-blood of the river. For instance, at the time I examined it, the lake of Karunalik was receiving through a very small feeder a volume equivalent to over 80 cubic feet in the second. Thus this one small lake alone drains away from the Tarim close upon 300,000 cubic feet of water every twenty-four hours. This, then, is a striking characteristic of the lower Tarim. Instead of gathering itself together and pouring its waters in a body into the terminal basin, it filters itself away in a number of lagoons strung all alongside the principal channel. And as the lower-lying portions of the region become filled and raised by the accumulated sedimentary matters which the river brings down with it, the lateral lagoons flit steadily higher and higher up the stream. Many of these lakes are carefully preserved by the natives for the sake of the fish which they contain. First they stop up the channel which supplies the lake with water from the river. This causes the lake to become stagnant, and it begins to shrink by evaporation, whereupon the water becomes slightly salt, which is believed to make the fish bigger and more palatable. The natives catch them in a drag-net pulled along by two canoes.

In this region the river makes its way immediately along the foot of the sand-dunes. You would think these sandhills would be swept away by the unceasing wind-storms which prevail; but one I measured, which stood close to the bank, rose to a height of 295 feet, and this was not the highest I saw in that position. The simple explanation of this fact is that the river-bed shifts as the sand shifts—that is, towards the right, or westwards. And, as a matter of fact, we have seen that the Tarim formerly flowed down the bed of the Kum-daria, or nearly due east, instead of, as now, towards the south. Sometimes the river is undecided in its course. It overflows its banks and makes its way

through lakes choked with reeds. Tirvadalu-koll, where it was only by the utmost exertions that we were able to punt our boat along through the unprecedentedly dense masses of *kamish* (reeds), was a lake of this description. The only way to get along was to set fire to the vegetation and burn it down to the water's edge, and then cut a channel through the tight-packed reed-stalks which remained.

Towards the end of May we became enveloped in veritable clouds of gnats and gadflies, and I was forced to have a hut put up on the fore-part of the deck instead of the tent. Meanwhile the heat increased day by day.

On May 25 I travelled by canoe to the Lake Beglik-koll, and sounded it. The great sheet of water was as placid as a mirror, and reflected the sand-dunes with the accuracy of a camera. Towards evening, after my work was done, we landed on the west shore of the lake to rest. But Kirghin Pavan, one of my old friends who dwelt in that part of the country, pointed towards the sand-dunes in the east, and cried, in a tone of interrogation, "Kara-buran?" ("black storm"), which signifies a desert storm of the worst description. At that moment an inky black pillar towered up on the horizon and bent its head forwards across the desert, whilst several similar pillars leapt up beside it like buttresses, supporting it. Then they melted together into one continuous wall, which rose higher and higher in the air. The lake, however, in spite of the oncoming storm, still maintained its mirror-like placidity. As we had still a good distance to row before we could enter the channel which led into the Tarim, I gave the order to start at once. The men rowed with such desperate haste that every moment I expected to hear the paddles snap in two. Their backs were bent like bows as we raced along over the sleeping waters, making the foam spin high off the bows of the canoe. We were going at the rate of 5½ miles an hour. The atmosphere was still calm, but as we watched the portentous swiftness with which the tempest bore down upon us, we felt the full premonition of the appalling change which was about to take place. Such moments as these are magnificent, but put a severe strain upon one. "Now it's got to the sand-dunes!" cried one of the men. I glanced up and saw the outlines of the dunes disappearing as though they were being washed off a slate, and in a moment the entire labyrinth of sand-dunes, together with the lake shore, was engulphed in a thick yellow-gray fog. "Row, row!" shouted the Mussulmans. "Allah! Yes!" came the answer in hollow and awe-struck tones.

Down came the first gusts of wind from the east-north-east. With a mighty roar the "black tempest" swooped down upon the water, which, hissing and boiling, was in two minutes lashed into huge waves of white foam. Our boat flew along at a terrific pace nearly 7 miles an hour. We were only about 1 mile distant from the northern shore. "By Allah! we can't do it!" was the cry. But just at the moment

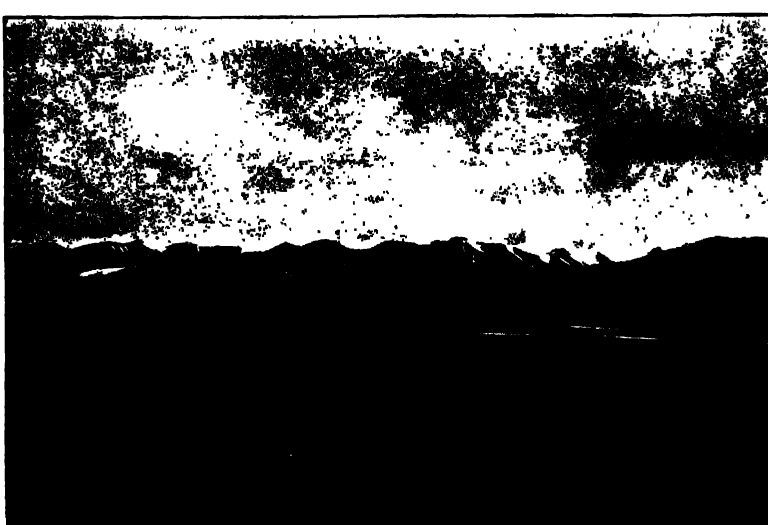
when the tempest seized us in its grip, and would assuredly have capsized our frail craft if we had not thrown all our weight over on to the windward side in time, we were suddenly enveloped in an impenetrable fog of the finest dust. All our surroundings were absolutely blotted out, and we became lost in the darkness. The utmost we could distinguish was the nearest waves, up and down which our canoes danced like straws.

We were at our last gasp, so to speak, when we caught the first glimpse of the tamarisks looming through the fog. The canoes were so full of water that they were ready to sink; but we were protected by a tongue of sand which acted as a breakwater. Once on the lake of Gollmeh-ghetti our two canoes did fill with water, and sank out in the open lake. But fortunately the water was so shallow that we were easily able to walk ashore. The depth in none of these lakes exceeds 36 feet, and the greatest depth is always found close to the eastern shore, under the shelter of the steep sand-dunes.

Beyond Argan the Tarim again swells out into a large and powerful river flowing in a well-defined channel. We now pushed on rapidly, often keeping it up until three o'clock in the morning, to escape the gadflies. The way was led by torches and lanterns, which flitted ahead like St. Elmo's fires, to the accompaniment of an accordion which I had brought with me to entertain the people. One evening we were overtaken by a canoe, which came creeping alongside of our big boat like an eel. It turned out to be a courier from Kashgar bringing me letters from home. That, I need hardly say, was a "red-letter day" to me in the solitude of the desert. At the fishing hamlet of Chogghelik I abandoned my trusty old craft, to the great delight of the grateful natives. The only way by which the remainder of the journey, as far as Abdal, could be accomplished was by tying our canoes together, covering them with a deck, and setting up tents upon it. At Abdal I rested some days, and, with the ready help afforded me by my handy and reliable Cossacks, I prepared my mail-bag and got ready a number of photographic plates. At the same place I also made a collection of the popular songs, which for centuries have been sung by the poor but interesting fisher-folk who dwell there. Then, but with a smaller caravan, I continued my journey towards our principal camp at Mandarlik in the Chimen-tagh. And there we were all once more collected together again.

From that place I sent back Sirkin and Chernoff to Kashgar, to fetch some Chinese silver money, some tinned provisions, and my letters, and on July 20 I started upon a difficult and exhausting journey right across Eastern Tibet. I appointed the Cossack Cherdon my *valet-de-chambre*, and Turdu Bai *karavan-bashi*, or headman of the caravan. One of the most useful members of my company was Abdat, the hunter, who knew Northern Tibet from having spent six winters amongst its mountains

THE TARIM, NEAR KARAUL.



ARKA-TAG CHAIN.

hunting wild yaks single-handed. He did this to make a profit out of their skins. My caravan consisted of six men, seven camels, twelve horses, one mule, sixteen sheep, and two dogs. The greater part of it, however, under the leadership of Shagdur and Islam Bai, was instructed to proceed later on to Temirlik, and there wait until we joined them.

It was fine summer weather when we left Mandarlik: but we had barely gone two days' march when we encountered a violent snow-storm. Under cover of this, a band of venturesome wolves came and frightened our flock of sheep out of the camp and killed nine of them. Later on we captured two young wolves, and tried to take them with us; but one escaped, and the other gnawed himself to death.

Three days' journeying from the principal camp brought us over the mountains of Chimen-tagh, and the fourth over the parallel ranges of the Arka-tagh and Kalta-Alagan, by high but easy passes. Among these mountains I always had so much to attend to that I seldom got into camp until long after the rest of the caravan. One day the conformation of the country was more than usually complicated, and when darkness fell, putting a stop to all further work, I found myself obliged to spend the night with my Cossack attendant in the open air, without either warm clothing or supper.

On the south of the Kalta-Alagan mountains the surface is level or slopes imperceptibly down towards the sister lakes of Kum-koll, one of which, the upper lake, contains fresh water, but the other, the lower lake, salt water. Beyond these lakes again there stretched a belt of drift-sand, with dunes over 150 feet in height. The steppe was dotted with thousands of grazing *khulans*, or wild asses. My men contrived to catch two young ones, and very soon they became perfectly tame. We fed them with milk-porridge, which they drank greedily; but in spite of that they would not thrive, so I had them killed. The natives declared it would be useless to turn them adrift to rejoin their mothers, for the old wild ass refuses to take any notice of her offspring once they have been in the hands of man.

During the latter part of July we marched straight on south, towards the Arka-tagh, and crossed successively its four parallel chains one after the other. This tried the animals' strength severely; but they came through it all right. Amid these complicated mountain chains it was not always easy to hit upon the best road; and every time we found a fresh snowy range confronting us, I had to send a horseman on ahead to reconnoitre the way. On August 8 we went over the fourth of the parallel chains of the Arka-tagh and descended into the great longitudinal valley which I traversed in 1896. In the evening we could only get a little warm tea to drink, after we had broken one of our boxes to pieces to make a fire with. Here we encamped on the shore of a salt lake in a region of unmitigated sterility. The very bottoms of the valleys are here some 350 feet higher than the summit of Mont Blanc.

Next we floundered into a region which, for pure "cussedness," is absolutely without a parallel. The surface consisted of sand and mud, saturated with water like a bog, so that the animals sank in it up to their knees. The moisture, becoming thickened by the snow and hail, does not run off the ground, but sinks down into it, making it soft and spongy and fearfully treacherous. Our animals kept falling incessantly, and every time had to be unloaded before they could be got up again. This part of the journey cost me one camel and one horse. There was not a blade of grass to be found anywhere; and the continuous falls of snow, mingled with hail, caused our camels to suffer so much from the cold that we were forced to give up every sack and blanket which could be spared to make into rugs to keep them warm.

After crossing two fresh mountain chains, with extensive, but short, glacier-fields, we encamped, on August 21, on the northern shore of an unusually large salt lake. This I decided to cross by boat in the company of one man, Kutchuk, to act as boatman, while the caravan went round by the west side to a point indicated on the opposite or south shore.

The course I steered across this very remarkable lake was towards the south-east. The eastern shore was not, however, visible. Our six-foot punting-poles touched the bottom in almost every part; and the boat itself had to be carried more than a mile before it could be made to float. The bottom of the lake was covered with a thick encrustation of salt, over the rugged surface of which it was not pleasant to walk barefoot. The water is so salt that the indicator of my hydrometer came to a standstill a couple of inches above the surface, and I had to make a special mark on the glass to preserve the register. Everything in the boat—instruments, punting-poles, tackle, clothes—all became as white as chalk, or looked as if they had been dusted with flour. The drops of water which fell from the punting-pole were converted into rods of salt, which looked like stearine candles. No wonder this lake was as sterile as the Dead Sea.

When we reached the southern shore it was rapidly growing dark. But there was not the slightest sign of the caravan to be seen. Accordingly, we had no alternative but to spend the night on the desolate shore without either food or water, and the only shelter we could find was the two halves of the English boat. Kutchuk, the boatman, turned one half of the little boat over me as though it were a bell-glass; and in that way I slept, although my narrow domicile reminded me forcibly of a coffin, more especially as Kutchuk heaped up the sand all round the edges to keep out the draught. It came on to snow; but we cared little for that, though the big flakes pattered on the oil-skin covering of the boat like so many tiny spirits of the air trying to get in to us.

The next day, aided by favourable winds, we sailed to the west, and found that the caravan had been stopped in its march by a stream,

160 feet wide and 10 feet deep, and had consequently encamped on its northern bank. We raked together everything which in any way partook of the nature of a rope, tied them all together, and stretched them across the river between two firmly fixed camel ladders, and in that way conveyed the baggage across in thirteen instalments. The horses swam over of their own accord, but the camels were troublesome. They refused to budge an inch, wouldn't lift a foot, and lay down composedly in the middle of the stream, and even left us to hold their heads above water with stout ropes. In the mean time my little collapsible boat, which in itself made a fourth part of a camel's load, was of great assistance to us in conveying over the rest of the caravan. The river which caused this obstruction flowed out of a fresh-water lake, fed by swift glacier torrents, and, at the time of which I speak, was carrying down 1625 cubic feet of water per second.

As we travelled on towards the south, our provisions began to give out, and there was only ammunition enough for Aldat the hunter's Asiatic gun. At camp No. 36, where there was fair pasture, I gave the camels a nine-days' rest. Meanwhile I, with some of the better-conditioned horses and three men, made an excursion to the south-east, to examine and map a highly peculiar lake-region, where water was more plentiful than dry land. Two large fresh-water lakes, extending from west to east, gather up several streams and brooks from over a very considerable area, and give off another broad stream which enters a salt lake situated farther northwards.

On the northern shore of the eastern lake red sandstone cliffs plunge sheer down into the water. Here we fished one morning with great success; and, whilst the other members of the caravan marched round the lake, Kutchuk and I measured its depth, and found it to be 157½ feet. Here again we were overtaken by a hailstorm; but, fortunately, the wind was favourable, and we drove southwards at a tremendous pace. The inside of our little boat became quite white with hail and snow, and we failed to get even a glimpse of the shore. But before we landed at sunset the storm had passed over. The western lake also was sounded in a snowstorm. I now decided to make for the west and the north, and to cross the mountain chains which we had climbed over on our way south, and so return to Temirlik. While the caravan under the direction of Turdu Bai turned towards the north, I, accompanied by Cherdon and Aldat, rode towards the south-west, to examine a snow-covered mountain knot which I saw in that direction, and four days later we rejoined the rest. After this, on the second day, we pitched our tents at the highest elevation I have ever encamped in Asia or elsewhere. The hypsometers and aneroids registered 15·2 inches; consequently we were halfway through the atmospheric envelope which surrounds the earth. A few hundred feet above the spot where we were encamped we saw an old yak licking the lichens and moss from the stones.

Aldat crept upon him like a cat, and brought him down at 30 paces. But that proved to be Aldat's last achievement: for he fell violently ill, and had to be carried along on the back of a camel, and at the end of a few days he died. We buried him in the wilderness, and raised above his grave a tent-pole, with yaks' tails fastened to it, and a strip of cloth with the date written on it in Arabic and Roman numerals.

On September 14, at our fiftieth camping-place, we encountered a snowstorm, the equal of which I have hardly ever seen even in the Alai valley. The snow simply came down in sheets, and was driven by the wind into snow-wreaths with amazing rapidity, so that in a few minutes my tent was surrounded by a high thick wall; and it was impossible to obtain either firewood or pasture for the animals.

At daybreak on the morning of September 17 we were awakened by a fearful racket from the dogs. A bear had coolly walked right into the camp, and was going about sniffing and inspecting everything, and when the alarm was given, trotted off again with the same *nonchalance*. As we had to be economical with our ammunition, he was allowed to go away scot-free. Cherdon was a good shot, and a capital hand at bringing down yaks, khlans, and antelopes, but I forbade unnecessary shedding of blood.

Here again the surface consisted of nothing but pure mud; but as it froze sharply at night, the ground was hard in the morning. On one occasion, however, one of the camels broke through the frozen crust and sank into the mud. We at once ran and pulled off his load and his pack-saddle; but the harder we worked the softer grew the ground all round him, and before we had done he was like a toad in a basin of porridge. At last we managed to pull him out, one leg at a time, by putting felts under each foot as we got it up; but the poor brute was utterly exhausted, and looked like a half-finished piece of statuary still in the sculptor's hands.

At last, however, but again in the midst of a raging snowstorm, we once more crossed the Arka-tagh, and encamped on the western side of the lake of Achik-koll. On October 6, still going north, we crossed over a pass in the mountain chain which forms the northern boundary of the basin of Achik-koll. The cold was intense, and here again also we had to contend with a violent snowstorm. Five horses succumbed on the summit of the pass. There was not a blade of grass to be had, not even so much as moss. After that our route still lay northwards through the well-defined valley of Fogri-Sai, fenced in by granite escarpments. In this region we chanced upon a so-called *kan*, or deposit of gold, which, however, was deserted for the autumn and winter. I also found at a spot where the valley begins to open out an interesting carving, representing a tiger, yak, and antelope hunt. It was of considerable antiquity, for the hunters were depicted as using cross-bows. Another discovery in the same region was an *obo*, or religious stone

monument erected by Mongolian pilgrims, and inscribed with the Buddhist formula of prayer, "On maneh padmeh hum." Here also we fortunately fell in with a couple of yak-hunters, whom I sent on to our principal camp with a message asking for assistance. After losing two or three more camels and horses, we at length struck the broad valley of Chimen, and pushed up it at an increased speed, doing up to 26½ miles in a day. On October 16 we caught a glimpse of a fire in the far distance—to us, who for three months had not seen the face of any human being except ourselves, a most welcome sight. But although we pressed on until midnight, we were unable to reach it, and, thoroughly done up, were compelled to encamp where we were. It was Islam Bai, who perceived us the next morning, and soon after met us with fifteen horses laden with provisions. This was on October 16. Four days later our wanderings came to an end; we entered the head-quarters camp, Temirlik, and were once more at home.

My next expedition was one of twenty-five days' duration, its object the exploration of the mountain chains which shut in the valley of Chimen on the north and on the south, as well as to take soundings in the lake of Kum-koll. Accordingly we crossed the Chimen-tagh and the Kalta-Alagan mountains to the shores of the salt lake, upon which I spent two days boating. We found that the greatest depth of the Kum-koll was 75½ feet. It was decidedly cool sleeping out in the open air with the thermometer down to 8½° below zero. One of my men was attacked by a disease in his feet, which dropped off piece by piece. However, we managed to save his life.

My journeys were not, however, yet at an end; but on December 12, 1900, I again left Temirlik with an escort of nine men, eleven camels, ten horses, and three dogs. After paying a visit to the salt lake of Gas-nur, we struck up through a valley in the Akato-tagh. At the top we encountered a difficult pass, where steps had literally to be hewn out and the camels assisted over one by one. We then continued our march between the parallel chains of the Astyn-tagh, where we came upon traces of an ancient Mongol road. On the first day of the new century we reached Anam-baruin-gol, and after spending twenty days in marching round the vast mountain knot of Anambar-ula, wound up by visiting the Sirting Mongols, who gave us a friendly reception and replenished our stock of provisions. The temperature now sank to 25½° below zero (Fahr.), which would not have mattered much had the wind not blown with such steady persistency.

From Anambaruin-gol I sent back two men and seven horses to Charkhlik, our next rendezvous. I did not think I could take more than three horses with me across the desert, and consequently ordered the rest of the men, at the end of forty-five days, to be on the northern shore of Lake Kara-koshun, three days' journey north-east of Kum-chappgan, with fresh horses and provisions, and my letters. And

I directed them to guide us through the desert by setting fire to the reed-beds in the lake every evening. On January 27, taking with me the remainder of the caravan, I left Anambar and crossed the Gobi desert west of Sa-chau, a journey of ten days, to the well of Tograk-kuduk, situated on the desert route between Abdal and Sa-chau. On the way we passed through several different kinds of country— steppes, low mountains, complete sandy desert, with sand-dunes of considerable altitude, and finally steppes again.

The little oasis of Tograk-kuduk was then made the starting-point of a dangerous but interesting journey. We took with us ice to last twelve days, for ourselves and the horses; and, as it turned out, it was precisely the quantity that was needed. Our camels were just beginning to feel the want of water, but on the whole bore the journey well. We marched northwards, at the rate of 20 to 25 miles a day, mostly over wretched *asar* (eskirs) and ridges, scarce big enough to be called mountains. They were, however, greatly weathered, and the country utterly barren and desolate, without a drop of water anywhere.

On February 18 came the first buran of the year; and it was so bitterly cold that we had to go on foot to prevent ourselves from being frozen to death. At night we were only able to make a little tea at the cost of two of the tent-poles with which to make the fire. On the 19th the storm still continued to rage; but as we had no firewood of any description whatever, we were obliged to content ourselves with sucking small pieces of ice and munching dry bread—hardly a fitting repast for such truly arctic weather as we were then experiencing. The tracks of wild camel were exceptionally frequent, and I observed them with the greatest interest, and noted them down on my map-sheet; they might later on point to important conclusions. Our situation was now critical. Our stock of ice was exhausted, and the camels had not drunk a drop of water for twelve days. Fortunately, that same evening we reached a spot where the wild-camel tracks all converged into one common track, which eventually led into a valley, in the beginning of which, sure enough, there was a salt-well, surrounded by a belt of fresh-water ice, a few inches thick. As fuel also was to be had in the same place, we stayed there two days, the camels, meanwhile, quenching their thirst by crunching the ice, which we hewed to pieces for them.

On March 2, in a dense fog, we approached the oasis of Altimish-bulak. I discovered that I was just under 2 miles out of my reckoning, which was not so very bad, considering that my route was determined by upwards of 10,000 compass observations, extending over a distance of more than 1300 miles. Here we sighted a large herd of camels, and Shagdur shot two of them, one being a full-grown he-camel, whose skin and skeleton we took with us. Leaving behind at the oasis three weak camels and all the horses, in charge of one man, I took with me the rest of the caravan, and sufficient ice to last for a week, and set out

CHARKHLIK.

NATIVES OF ABDALL.

to visit the ruins which I had noticed the previous year. We reached the place at the end of the third day, and made a stationary camp in the vicinity of a big tower, constructed of burnt and sun-dried bricks. Our investigations resulted in the discovery of a small village of nineteen houses, which I carefully surveyed, and then had dug out. Our finds embraced a lamp, some Chinese money, several small articles, the wheel of an *arba*, or Turkestan cart, various kinds of utensils, pottery, and wood-carvings, which had been used to decorate the houses, etc. In the village which Ördek had discovered the previous year we found and examined a small Buddhist shrine, which must at one time have been beautifully ornamented, as you will perceive from the specimens which are here displayed for your inspection. The interior of the shrine contained an image of Buddha enthroned. Its dilapidated trunk is also included in my collection. While the excavations were in progress, a small piece of wood was flung aside as being of no value; but I picked it up, and found it covered with native hieroglyphics, which the savants have not yet succeeded in deciphering. On the north the shrine seems to have been protected by poplar woods, but towards the south it looked out over the thick reed-beds which fringed the ancient lake of Lob-nor. On one piece of timber, by the way, there was, amongst other objects, a fish depicted.

The brick tower which I just now mentioned was 29½ feet high, and afforded an excellent view over the desert. I wondered whether it was in any way akin to the *stupas* which are found near Kashgar, and tried to dig through it. But there was nothing in its interior. It was probably a watch-tower, or signal-tower, in times of war, fires being kindled at its corners.

We discovered three other similar towers, and four villages altogether. It is of importance to remember that all these ancient habitations lay on a line which ran from the north-north-west to the south-south-east, and which, consequently, coincided with a great high-road that led along the northern shore of the lake. In two or three of the houses there were large quantities of fish bones, of the same species as those which now live in the Kara-koshun. Amongst other things we also found wheat and rice, and parts of the skeletons of sheep.

In another of the houses, built of sun-dried brick, and resembling a stable more than anything else, we came upon a large quantity of papers and letters written over with Chinese writing. This was a grand discovery. These ancient documents would throw a flood of light upon the history of the place. We prosecuted our labours with double zeal. But these were the only manuscripts we found, and they lay buried under 2 feet of sand. In the same place, however, we dug out forty-two small, narrow wooden wands, also written over with the same kind of writing. On my return home I sent these materials to the learned sinologue, Mr. Himly, at Wiesbaden, who is now deciphering them. As soon as he had

made a preliminary examination of them, Mr. Himly wrote saying that the data and other indications pointed to a period between the middle of the third and the beginning of the fourth century A.D. "The objects themselves appear to have belonged to a wealthy Chinese merchant, who supplied commodites of every description, let out carriages and beasts of burden on hire, besides conveying letters to Tun-kwang, *i.e.* Sa-chau. Travellers going to the latter city used horses, carriages, and even oxen. One of the documents appears to contain an allusion to a military campaign, but it gives no indication of date. Amongst the geographical names mentioned we find the very one which designates the country here in question, viz. Lau-lan. The inhabitants must also have been engaged in agriculture, for one of the principal items in the manuscripts consists of weights and measures of seed-corn; some of them also name this or the other kind of corn. Possibly there once stood on the site where the manuscripts were found an old revenue office, or a sort of 'grain-bank,' where grain was bought and stored, or received as security for loans advanced. The papers exhibit one strange peculiarity, in being written on on both sides—a practice which does not now obtain in China either in writing or in printing.

"In any case, the collection of manuscripts which you have brought home with you is one of great interest, even to the Chinese, and will unquestionably form the subject of scientific speculation for some time to come. Some of the sheets are nothing more than simple exercises in writing; others consist of fragments only. But in both cases the style of writing differs but little from that which is now in use in China. The wooden wands have this advantage over the paper manuscripts, that each contains one or more complete sentences: as, for example, an antelope is delivered, such and such a quantity of seed-corn has been handed in, or so many men have been furnished with provisions for a month, or longer. To judge from one passage, the official who lived at this place would seem to have governed a pretty large province. The passage runs thus: 'The approaching army is to be met at the frontier (or the shore?) by forty officials, and the farmsteads are many.' He seems also to have had two native chieftains in close dependence upon him. The majority of the dates in the manuscripts fall between the years 264 and 270 A.D. In 265 the emperor Yuan-te of the Wei dynasty died, and was succeeded in the north of China by Wu-te of the Tsin dynasty, who died in 270. Most of the copper coins that are legible are what are known as *wu-chu* pieces, a variety which was struck between 118 B.C. and 581 A.D. Numerous other pieces belong to the *hwo-tsian* mintage, which goes back to Wang-mang, who held the reins of power between 9 and 23 A.D. Thus the dates on the coins agree fully with the indications of date conveyed by the letters and the wooden wands."

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* See the following article by Mr. Macartney.

These few observations by Mr. Himly, on his first cursory examination of the materials which I have brought home with me, will serve to indicate the value of the information which I have been instrumental in unearthing from the sands of the great desert of Central Asia. For one thing, they throw unsuspected light upon the physical and political geography of the interior of Asia during the first centuries after Christ, and show what prodigious changes have taken place in that part of the world during the last fifteen hundred years. The name Lau-lan occurs in the writings of Edrisi, and a learned mandarin in Kashgar, to whom I showed the manuscripts, told me that, according to the old Chinese geographies, the country round the present Pityan, near Turfan, was formerly called Lau-lan. Read in connection with the physico-geographical investigations which I have made into the movements of the lake of Lob-nor, these historical data are of inestimable value. Not only do they give us information about the country of Lau-lan on the northern shore of the ancient Lob-nor, but they also throw light upon several unsolved problems connected with the region which lies halfway between China and the countries of Europe. They tell us there was a regular post between Lob-nor and Sa-chau, and, consequently, there must have been a route of regular communication through the desert of Gobi. The ancient road which ran from Korla alongside the Concheh-daria, where I previously discovered a chain of brick towers (*pao-tais*), as well as the fort of Merdek-shahr, acquire an entirely new importance in the light of these more recent facts. Numerous ruins exist also at Yin-pen, another important station on that same highway.

The question of agriculture, having been followed in ancient times in Lau-lan, is one of very great interest. How was it possible to carry it on? Not one rivulet flows down from the Kurruk-tagh mountains; not one drop of rain ever falls from the sky. Canals, or irrigation *ariks*, similar to those which are found all over Eastern Turkestan at the present day, must have been made from the river which flowed into Lob-nor. The grain-banks spoken of still exist in every town in Eastern Turkestan, under the control of the Chinese authorities, and serve the purpose of securing an equal distribution of bread amongst the natives. True, I unearthed four villages only, one of them consisting of not more than nineteen houses; but there is no reason why the desert should not yet yield many other valuable archæological remains. The mention of forty officials, a military expedition, and many farms, points to the inference that Lou-lan was a well-peopled region. Possibly the people dwelt in perishable reed-huts, as they do at the present day. Time, however, will not permit me to linger longer on this interesting subject. I must return to my journeyings. As soon as I arrived at the ruins, I sent the camels back to Altimish-bulak, to get pasture and fetch ice. Upon their return, at the end of a week, we broke up camp, and marched southwards, beginning what turned out to be a most interesting

and instructive journey across the desert. My own party consisted of one Cossack, three Mussulmans, and four camels. The rest I sent, under the command of Faysulla, who had accompanied me the year before, to the south-west, with instructions to try and get to Kum chappgan. In this, however, they failed, being stopped by vast sheets of water of quite recent formation, so that they were driven as far west as the Tarim. And I was consumed with anxiety about them until I learned they were still alive, though they lost all their horses and ran short of supplies. Meanwhile we in our party had a difficult and tedious task to perform, namely, to take exact instrumental measurements for determining the slope of the desert from north to south; that is to say, from the northern bank of the ancient Lob-nor to the northern shore of the existing lake of Kara-koshun. The contours of the region were, however, peculiarly favourable for our purpose, being as level as the sea, except for the furrows scooped out by the wind, so that I was able to continue my measurements in a direct line, without hindrance. The distances between the levelling instrument and the staff were taken with the tape, and the total distance worked out at 50½ miles. This cost us eight long days' work, and of course obliged us all to go on foot; but we took four camels with us, chiefly to carry ice.

On the very first day we had an adventure which might have proved disastrous. I myself started early, with my assistants and my levelling instruments, after giving orders to one of the men to follow on with the camels a couple of hours later, make a *détour* round us, and then meet us at the appointed camping-ground. One of the camels carried, amongst other things, all my maps and note-books. We worked on all day, and measured 5 miles and 1196 yards, and in that distance there was a fall of only 7½ inches. When darkness set in the caravan was nowhere to be seen, and we made a big signal-fire at the edge of the dead forest, which happened just there to come to an end. Shagdur set out to hunt for the caravan. If it had missed us it was doomed, and our situation, too, would be very critical, for we had not one drop of water with us. But fortunately our signal-fire was visible at a great distance, and the camel-driver turned up in the course of the evening with everything all right.

That same night a storm got up in the east, and compelled us to strike work for the whole of the next day. But Shagdur had not returned. However, as he was provided with a compass, and was quite familiar with my methods of mapping, I had not the slightest anxiety on his account. As it turned out, he did take the precaution of noting his compass bearings the moment he left the camp, and during the course of the next day he turned up all right. This I regard as a triumph of native intelligence, seeing that the region was perfectly flat, without any distinctions of contour, and a violent storm, accompanied by an impenetrable fog, was raging all the time.

As soon as the storm subsided, we continued our levelling operations, and by the end of another day had descended 8 feet $2\frac{1}{2}$ inches. In fact, we crossed over a depression which lies $26\frac{1}{4}$ feet below the level of our point of departure. During the two following days we again ascended 10 feet 10 inches, but during the last three days once more descended something like 10 feet. The result of the cubic measurement showed that the surface of Kara-koshun lay 7 feet $5\frac{1}{2}$ inches below our point of departure on the northern shore of the ancient lake of Lob-nor. At the same time it must not be forgotten that during a great part of the second and third days we were down below the present level of Kara-koshun, and that our camp on the second day of our operations was pitched 8 feet $8\frac{1}{2}$ inches below the point of departure. Without stopping to analyze exhaustively the results of this remarkable survey of over 50 miles, I will only pause to observe that it proves in the most conclusive way the existence in the northern part of the Lob desert of a depression with a depth precisely similar to that which I sounded in Kara-koshun.

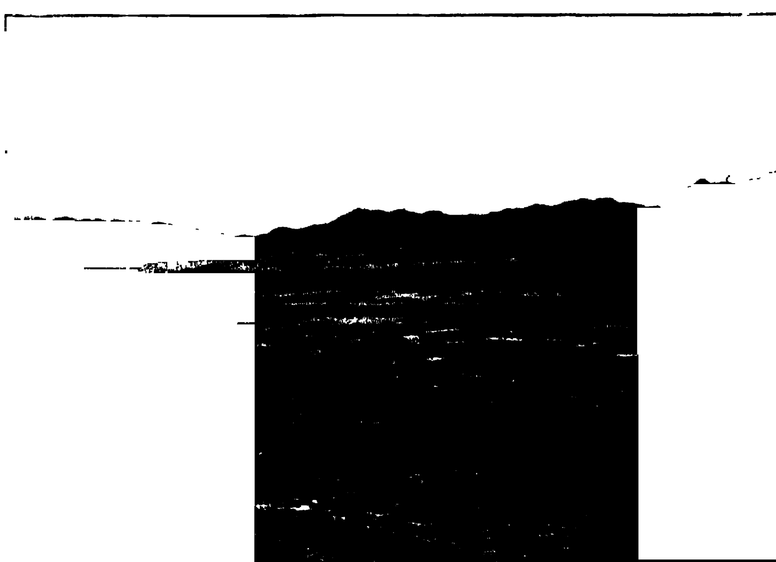
Upon reaching the northern shore of this latter lake, our labours came to an end, and our next step was to hasten back to Charkhlik, where the main body of the caravan was supposed to be encamped. I had instructed Tokta Ahun, one of my men, to go three days north east of Kum-chappgan and there light signal-fires for our guidance. But as we were unable to see these, and the country grew perfectly barren as we approached the lake, I sent on Khoda Kullu, another of my men, westwards, on foot to look for them, and guide them to us the moment he found them. But for several days nothing more was heard of him, and as, in the mean time, we were reduced to a few ducks which Shagdur managed to shoot, I resolved to follow after Khoda Kullu. But after going one day's journey along the lake-shore, we were stopped by a vast sheet of water, stretching towards the north-east, which we could neither see across nor get across. Just when we were becoming hopelessly entangled amid this labyrinth of waters, we perceived three horsemen coming galloping from the north-east. The riders were my faithful Cossack Chernoff, Tokta Ahun, and Khoda Kullu, the man I sent out in search of the caravan. The latter, it appeared, had travelled for five days before reaching the encampment, and when he did arrive he was half dead with hunger. Now, strange to say, the encampment he went in quest of was all this while not more than 2 miles distant from our own, and had there not prevailed a dense fog during the whole of this time, we assuredly should not have missed seeing their signal-fires. It will appear almost incredible that Khoda Kullu should have taken five days to ride a matter of only 2 miles, but the fact was there lay between the two camps a newly formed arm of the river, flowing with a volume of upwards of 1130 cubic feet of water in the second. We ourselves were hemmed in on both sides by this

stream. As the water flowed northwards at a prodigious rate, forming a new lake as it went, it took us four days to get round it. It had cost the mounted men three days' hard riding to reach us, and as we returned we found their horses' hoof-marks already under water, in some places at a depth of 18 inches. Indeed, the water bubbled and boiled along at such a rate, and over such a wide stretch of country, that it was dangerous to encamp anywhere near its margin. Consequently, we were obliged to travel halfway back to the ruined villages before we could turn to the west. After that we bent round to the south, until, finally, we reached the caravan encampment, and found there everything we needed.

The lake of Kara-koshun, which is thus gradually disappearing in the place where Prjevalsky found it, is slowly creeping northwards, seeking to return to its ancient bed, where, I am perfectly convinced, it will be found at no great distance of time.

That such great changes as these are able to take place in this part of the world, which my measurements have shown to be almost perfectly horizontal, is not at all surprising. The lake of Kara-koshun, which has occupied its present situation for a very long period, is getting choked with mud and drift-sand and decaying vegetable matter, while, on the other hand, the northern part of the desiccated desert is being eroded and furrowed by the winds, and is thus growing deeper and deeper every year. The basin which serves as the terminal reservoir of the Tarim system must necessarily be extremely sensitive to these changes of level, determined as they are by purely mechanical laws and atmospheric depression of a strictly local character. It is simply a physical necessity that the water of that reservoir must ultimately overflow its basin and seek a relatively lower level. Thus a drop of some 3 or 4 feet in level is sufficient to cause, through the action of the wind, a total transformation in the map of the district. As the lake moves, so do the vegetation and the various animals of the desert. They, as well as the fisher-folk, with their reed huts, follow after to the new shores, while the old lake gradually dries up. In the far-off future the same phenomena will recur again, but in the reverse order, though the natural laws which will effect the reversal will remain precisely the same. Whenever that occurs we shall be in a position to determine, on the basis of a more complete accumulation of data, what is the length of time required for these periodic movements. This, however, we do know already, with perfect certainty, that in the year 265 A.D., the last year of the reign of the Emperor Yuan Té, the lake of Lob nor lay in the northern part of the desert. Lob-nor is, as it were, the oscillating pendulum of the Tarim river, and even though each oscillation extends over a space of a thousand years or more, yet, measured by the clock of geological time, we know that such periods are of no more account than so many seconds of *our* time.

PART OF THE NORTH SHORE OF BANGGONG-TSO.



NORTH SHORE OF KUM-KOLL.

After the completion of this journey, I pitched my camp at the little town of Charkhlik, on the edge of the desert, and gave myself a month's much-needed rest. Meanwhile, however, I organized and equipped the largest caravan I have ever led into unknown regions. It comprised 30 Mussulmans, 4 Cossacks, 1 Mongolian lama from Kara-Shahr, 39 camels, 45 horses and mules, 70 asses, 50 sheep, and 8 dogs.

Both men and animals were in the very pink of condition, and a picturesque and imposing array they made, for it was the most considerable caravan ever conducted by a European into Tibet. And yet how different was its appearance at the end of the year! How decimated and shattered!

I sent on the caravan, under the command of two of the Cossacks, by well-known trails over the mountains which run along the northern boundary of Tibet, and so up on to the great plateau of that country. I myself, taking with me the other two Cossacks and some of the horses, rode up by the bed of the little river Charkhlik, a most disagreeable road, encumbered as it was with loose stones. One day we crossed the stream no less than sixteen times, getting several wettings in doing so, but we did not lose anything except one horse-load of supplies. Finally, after an instructive journey over many difficult passes, we reached the western shores of the lake of Kum-koll, the appointed rendezvous.

On June 4 we beheld in the distance the long black line of the caravan slowly wending its sinuous way towards us. It was quite a pleasure to watch them battling up through the storm, while the water of the lake, crumpled into big waves, was dashing against the shore. The two Cossacks in command, Chernoff and Chordon, putting their heels into their horses' sides, galloped on ahead to my tent and reported, in military style, that all was safe, and then the whole party filed on past me in procession, which took them a good hour to accomplish, the camel-bells meanwhile jangling in solemn harmony. And when they were all settled down into their new quarters they gave the lake-side the appearance of a busy market.

My plan was to march on southwards until we reached a region with tolerable pasture, and there establish a fixed camp as a basis from which to carry on further operations. But a difficult piece of country still lay between us and the Arka-tagh, the highest mountain range on the face of the Earth. The ground was soft and gave way under the animals' feet, and we got entangled in a bewildering labyrinth of exasperating small hill ranges, where we were again and again obliged to turn back and retrace our steps. Every day I sent on pioneers in advance to reconnoitre and find out the best route for the caravan to take. In one place we lost thirteen asses, in another nine: but we saved their loads, and packed them on the horses, though not before we had cut them down considerably. Upon reaching the foothills which stretch in front of the mighty chains that form the Arka-tagh mountains, we

rested a couple of days to reconnoitre and search for a pass. Here the animals got the last bite of pasture they ate for a long, long time.

We had just finished putting up our tents and *yurts* (or Kirghiz tents), and turned the animals loose to graze, when Chernoff came to tell me there was a big bear trotting towards the camp, seemingly utterly indifferent to the strange intruders on his domain. Two of the Cossacks seized their weapons and ran to meet him. Their shots rang out both at the same moment. Bruin sprang round, turned tail, and set off up a hill-slope. We followed after him on horseback. But before he reached the top his strength failed him. He fell, and came tumbling down to the bottom of the slope like a ball. He was an old male, of a dark grizzly colour, and had been hunting through the marmots' earths. To judge from his hollow teeth, he must at one time have been furnished with formidable jaws. I kept his skin and skeleton, and had them preserved.

From our last encampment on the north side of the Arka-tagh, I sent home ten men and such of the asses as survived, and then continued my march over the repellent mountains which, in my experience, have always been so formidable to surmount. We made our way up through sterile valleys littered with gravel, battered every day by violent storms of snow and hail and rain. In this way the animals' strength became more and more exhausted in proportion as their burdens were made heavier and heavier.

The final slope up to the summit was extremely precipitous, and we were repeatedly brought to a standstill by the exhausted camels. The snow lay deep all around, and a howling snowstorm made it impossible to see the road in front of us. Three camels fell just below the pass, and were unable to get up again, so that we slaughtered them and left them, and two others shared the same fate on the summit of the pass. I did not doom them until it was unmistakably certain that their strength was utterly expended, then we put an end to their sufferings, a red stain on the snow showing where their bones would soon lie bleaching under the terrible winds of those awful altitudes.

Once over the pass of the Arka-tagh, we pushed on south through an absolutely unknown region, where we crossed innumerable mountain chains, over passes of stupendous height, skirted the shores of innumerable lakes, and forded innumerable rivers, but almost the whole time through a barren country, totally devoid of grass, so that every day the caravan animals grew more emaciated. We continued to shoot yaks, wild asses, and antelopes, and consequently were in no want of meat. The Cossacks also kept the camp supplied with partridges and wild geese.

The same parallelism in the mountain ranges which prevails throughout the whole of higher Asia characterizes the region of which I am now speaking—that is to say, the chains run from west to east,

and as we were travelling from north to south, we had consequently to cross over every one of them.

At camp No. 32 I weeded out the twelve worst camels, besides a number of inferior horses, and left them to follow on after us at a slower pace, under the charge of the Cossack Chernoff and four Mussulmans. Then, taking with me the rest of the caravan, I pushed on all the faster towards the south.

Rain and snow had made the ground as soft as pap; indeed, it was as though the earth were attenuated like the atmosphere, and were unable to sustain any weight. On one of the worst passes a big camel literally sank right into the bog, and could not be rescued. Every time we endeavoured to approach the spot where he lay we ran the greatest risk of sharing the same fate. We could only hope that the next day, when the surface of the ground was stiffened a little by the frost, we might be able by sheer force to drag the poor beast up out of the slough of despond into which he had fallen. But during the night he sank deeper and deeper, and at length died, frozen fast into the odious, treacherous morass in which he was engulfed. Another camel, although perfectly well and sound, absolutely refused to move, and accordingly we left him on a declivity where there happened to be a few blades of grass growing, in the hope that he would stay there and rest until Chernoff picked him up. But unfortunately Chernoff at this place made a *détour*, and consequently never saw the camel. This was the only animal I ever left behind me alive in any of my numerous journeys.

As camp No. 38 yielded a bit of tolerable pasture, we stayed there two or three days to rest. Whilst we were there the Cossacks chanced to catch sight of a bear, and whilst following him up came upon a Tibetan encampment of three men, with horses and yaks. The Cossacks hurried back to bring the news to me; and I at once sent them back again, with the lama to act as interpreter, to glean some information about the region we were in. But when they reached the place the Tibetans were gone, and our horses were not in a good enough condition to admit of our following them.

We learned afterwards that the Tibetan hunters posted off southwards and told the nearest native chiefs that an army of Russians was approaching from the north. Hence our arrival was known long before we suspected it, and a sharp look-out was being kept throughout the country north of Lhasa and along all the roads which led to that mystic city. I strongly suspected that this encounter with the Tibetan hunters would bode us no good. Accordingly, when we found there was very good pasture at camp No. 44, besides traces of recent nomad encampments in the neighbourhood, I decided to make that my main camp or base for further expeditions. At the same time I made haste to complete my Mongolian equipment, and after having made quite sure of

the position of the camp by astronomical determination, on July 27 I started for the south, accompanied by the Buriat Cossack Shagdur and the Mongolian lama. I left Sirkin in charge of the camp, with instructions to move on to some other place as soon as the pasture was done, and when *that* was finished to move on again to a third place, and so on. But he was always to leave behind him in every encampment a report of what he was going to do, so that I might be able to follow up the caravan. My Mongolian equipment was very simple; it consisted of two small cases, a tent, provisions for a few days, some Chinese silver, and a few surplus furs, everything being of Mongolian manufacture. We lived also in genuine Mongolian fashion. However, I also took with me a few small note-books, an aneroid barometer, a thermometer, compass, and chronometer, so as not to be obliged to discontinue my observations. Those whom I left behind looked upon the undertaking as a piece of madness, and thought that surely I had taken leave of my senses. For the first two days Ördek accompanied us, to keep watch upon our animals at night, so that for at any rate two nights we might sleep in peace. The animals we had with us were five mules and four horses. At the end of our second day's ride, or when we had left the camp 46 miles behind us, I had my head shaved as bare as a billiard ball, and my moustache cut off altogether. I looked horrible; but then I was something like a genuine Mongol, especially after the lama had for several days smeared my face with grease, till I was partly black and partly brown. We were all in good spirits. Our tent was pitched on a neck of land between two lakes, one salt, the other fresh, and the horses and mules, guarded by Ördek, were peacefully grazing a short distance away. About midnight Ördek came rushing into the tent, and woke us up with the cry of "Robbers! Robbers!" We snatched up our rifles and revolvers and hurried out, but the dim moonlight was barely sufficient to show us some mounted men hurrying away over the nearest hills, taking with them two of our horses. All thought of pursuit was, of course, out of the question, because, for aught we knew, our camp might even then be surrounded by a whole band of thieves. We therefore sat round the fire and talked till daylight, when we struck camp and travelled on farther towards the south-east. Poor Ördek had to trudge the 46 miles back to camp on foot. My men there looked upon us as lost for good and all. But I left instructions with the Cossacks that, if I did not return within three months, they were to make for Kashgar and report. On the third day we made a long march, and in the evening perceived some Tibetan horsemen keeping a watch upon our movements from a distance. From this time onward we made it a practice to divide the night into three watches of three hours each, so that each of us had his three hours to do sentry-go. Fortunately, we had two first-rate helpers in Yollbars and Malenki, the two biggest and fiercest dogs my caravan possessed.

And we always pitched our tent so that the animals were tethered on the side that was against the wind, for it was from that quarter that night visitors might be expected, and the dogs were tied up one at each end of the camp-line. Never shall I forget those interminably long night-watches, when I tramped backwards and forwards between Yollbars and Malenki listening to every the least suspicious sound. I had not the slightest difficulty in keeping awake; any moment we might be suddenly fallen upon. Many and many a time the dogs set up a fearful barking. Thereupon I would hear a noise in a certain direction, and would creep towards it, revolver in hand. Then the dogs would stop barking, and everything become still again.

On the third night we heard horses' hoofs, and the dogs became very uneasy. But a reconnaissance of the vicinity revealed nothing suspicious. It rained cats and dogs, and when my watch was over I was wet to the skin. And even after I crept into the tent I could hear the sweet little rivulets of rain trickling amongst our few precious belongings.

Our fourth day's march led through uninhabited and very hilly country. It rained in torrents both day and night without once ceasing. I confess I never saw such rain. Our tent stood beside a little lake. Fortunately for us there was a moon, which was able to shed a gentle diffused light through the dense masses of cloud that hung in the sky, and by its means we were enabled to keep in sight, though it was not altogether easy to do so, the line of animals tethered in front of the tent. During my turn at watching two of the mules contrived to get loose, and I had no end of a business running up hill and down dale to catch them again.

On the fifth day of our march we did a very long ride, passing on the way a caravan of Mongolian pilgrims. Late at night we came to a black tent, the owner of which, Sampo Singhi, a shepherd, gave us a friendly reception, and sold us a sheep, which he suffocated by holding his fingers in its nostrils. He also gave us cream and sour milk, so that for the next few days we fared quite sumptuously. In the course of the following day's march we forded the river Satyu-sangpo, at that time tremendously swollen by the rains. It was the worst fording of a river I have ever experienced. The water in its deepest part came up to the pommel of the saddle, and little more than our horse's head and neck was visible above the raging flood. The mule which carried the two cases was swept away by the current, and floated a good distance down-stream, upheld by the cases, which acted as swimming-bladders. My horse slipped into deep water, and gave me a thorough drenching before he got his feet again. Our encampment on the opposite bank was of a tragi-comical description. Not a scrap of dry wood was to be had, the *argol*, or dried dung, refused to burn, and it was impossible to move a foot without splashing into a pool of water.

The next day, the seventh of our journey, we crossed a wide, open expanse, bounded in the far distance by a range of low mountains, and overtook a caravan of three hundred yaks, led by thirty Tibetans, and laden with Chinese tea for Tashi-lunpo on the Bramahputra (Sangpo).

The eighth day carried us over a couple of very high passes, beyond the second of which we entered a region fairly well peopled with nomads; their black tents dotted the clefts and slopes of all the mountains in the vicinity. The next evening we pitched our tent in a sort of corrie beside a brook, and had to the south of us the mountains which overhang Tengri-nor on the north. We had now travelled a distance of 180 miles from our main camp. Thus far were we destined to go, but no further. For just before it got quite dark we were surrounded by Tibetans, who announced that we were their prisoners, and that one step further would cost us our lives. Our lama was in a panic of terror, and believed we should be instantly slain. We accordingly halted, and awaited passively the progress of events. Thirty-seven sentinels were posted round our tent. We saw the Tibetans' fires through the mist in every direction, but more especially on the road towards Lhasa. The next day, too, we kept tolerably quiet upon perceiving a band of fifty-three mounted men, armed with long black muskets, swords, pikes, and lances, spring up like mushrooms out of the ground, and gallop in extended order towards our tent. Uttering a string of the wildest yells, or war-whoops, they charged straight down upon us, but, swinging off to both sides, drove on past, then wheeled round, and came back again like a hurricane, flourishing their pikes over their heads. After that they pitched their tents close to ours, and began to shoot. This they did, it would seem, to inspire us with respect. Our impression was, that, if they intended to take our lives in a polite manner, it was scarcely necessary to levy so many people to do it.

After a while this later band arranged themselves in little troops, and rode off in the direction from which we had come. They were all dressed in black and red cloaks; the officers wore big white hats, while the remainder had red bands round their heads. As a rule, however, the Tibetans go bareheaded, and never have their hair either combed or cut.

Meanwhile we were treated with the greatest friendliness by the first-comers. An old lama assured us that we had nothing whatever to fear; the Dalai Lama had given orders that we should be treated with the greatest consideration, and that all we needed in the way of provisions should be provided us free of cost. Accordingly they brought us milk, butter, and lard in their bowls, and presented us with more mutton and firewood than we knew what to do with, nor would they accept any kind of payment whatsoever in return. In the course of a few days, he said the "bombo," or governor, of the province of Nakchu

would arrive, and then we should know our fate. And in due time the said high official put in his appearance, and we soon saw a large village of white and blue tents spring up alongside the road to Lhasa. Through his interpreter, who spoke Mongolian, the governor invited me to a grand banquet in his tent, but I answered that, if he wished to see me, he was at liberty to pay me a visit. Accordingly, in the course of the afternoon, we perceived a crowd of horsemen gallop out from amongst the tents and ride towards us. They consisted of Kamba-Bombo, governor of Nakchu, and Nanso Lama, accompanied by several other dignitaries, besides officers and soldiers armed as if for a campaign—sixty-seven of them in all, each man mounted and dressed in handsome ceremonial robes. I question whether they ever clearly understood who I was; but, seeing the pomp and ceremony they assumed, it was evident they imagined somebody out of the common was disguised beneath my tattered Mongolian garb. Kamba-Bombo rode first, surrounded by his staff. He wore a costume of yellow silk, had on a red head-dress and Mongol boots of green velvet, and was mounted on a big grey mule, with a costly saddle, and had his saddle-cloth embroidered with silver and turquoises. He dismounted, and, followed by a throng of his officers, greeted me politely, and, stepping into our wretched tent, took his seat on a bag of maize.

All these men carried swords, suspended from richly chased silver belts, ornamented with corals and rubies. They wore, further, *gavos* (or talisman cases) round their necks, and were adorned with rings, bracelets, and other finery, and had their hats trimmed with feathers My honest lama was completely overcome by all this magnificence, and kept his eyes the whole time fixed on the ground.

Meanwhile Kamba-Bombo was in the very best humour, now that he had us completely in his power, and declared categorically that, no matter who we were, we must retrace our steps if we did not wish to have our heads cut off, at the same time drawing his hand significantly across his throat. I found it was perfectly useless to argue with him; he had imperative orders from the Dalai Lama. Thereupon he presented me with a couple of horses, a flock of sheep, and some provisions—gifts of priceless value, which, however, I was totally unable to return—and appointed an escort of three officers and twenty men to accompany us as far as the river Satyu-Sangpo on our way back. With these men we were soon on the most friendly footing, so that when they left us we felt quite melancholy.

At last, on August 20, we reached our main camp, thankful that we were still safe and whole in life and limb. For, although we had not had the good fortune to reach the "Holy City," we comforted ourselves with the thought that we had done our utmost to get there, even to the extent of risking our lives for that object.

With the full strength of my caravan once more behind me, I

proceeded southwards by a different route, being firmly resolved not to turn to the west until I should be compelled to do so by absolutely insurmountable obstacles. But we did not get very far before we once more had the Tibetans upon us. They sprang up on every side, their numbers increased, and they rode in close-ordered troops on both flanks of our caravan; then they disappeared, and anon reappeared, racing past us at full gallop.

With these bands we lived upon a sort of war-footing, and every night posted strong guards or outposts round our camp. We were but scantily supplied with ammunition; but luckily shots were not exchanged. When we showed signs of continuing our journey, the Tibetans sent a deputation to me, begging me, in touching terms, not to proceed further. When they found their request was unheeded, they hurriedly despatched couriers to Lhasa. Meanwhile we proceeded on our way.

One of my Mussulmans fell sick while we were on the shore of the lake of Naktsang-tso; so we made a couch for him on the back of a camel, and in that way took him with us when we marched again. But one afternoon, a few days later, when we stopped for the day, we found him dead on his living bier. On the following morning we buried him according to Mohammedan ritual, our molla reading prayers over his grave out of the Koran. The Tibetans watched our proceedings from a distance. They thought we were making a deal of unnecessary fuss over a dead man, and advised us to fling the corpse out to the wolves. Subsequently we witnessed how they did throw out a dead body to be devoured by vultures and ravens.

Later on that same day there was another rift in the lute. Hladyeh Tsering and Yunduk Tsering, two of the Dalai Lama's ministers or members of his *devashung* (or council) in Lhasa, came direct from the Holy City, bringing with them 500 mounted men, and against such a force I had no inclination to declare war. These officials read to me a proclamation from the Dalai Lama, which, amongst other things, contained the following passage: "Let letters be sent with all speed to Namru and Naktsang, that no Russian can have permission to travel on any of the roads of Nakchu and inwards as far as my kingdom extends. Let letters be sent to all the chieftains. Watch the frontiers of Naktsang. It is absolutely essential to guard strictly every part of the country. It is entirely unnecessary that any European shall enter into the kingdom of the holy books and spy out the land. In your provinces they have nothing whatsoever to do. If they say they have, then know they must not travel to Lhasa. And if they do travel, then shall you lose your head. See to it that they turn back by the way they came."

Autumn was now approaching, and we had a long way to go to reach Ladak. Nevertheless, I stayed where I was until I had mapped

Naktsang-tso and Selling-tso. Thus for ten days longer we were honoured with the company of our Tibetan escort, though we lived on the best of terms with its leaders. We visited one another every day, and they arranged a *jigitovka* (or play on horseback), in my honour, gave me horses and sheep, and throughout treated me with the utmost politeness. Our united camps presented an imposing spectacle, with their sheets of tents, their innumerable fires, their troops of horses and horsemen. While my caravan, escorted by the Tibetans, marched from the eastern shore of the lake of Chargut-tso, round by the northern shore, I and Kutchuk the boatman crossed it by boat to take soundings, the arrangement being that the caravan was to look out for us at the western extremity of the lake. But a more disagreeable voyage it has never been my lot to participate in. When the caravan had disappeared behind the mountains which shut in the lake on the north, and we were far out on the water, we were overtaken by a violent westerly storm, and it was only by dint of the very greatest exertions that we managed to reach a tiny rocky islet; and there we were kept prisoners for forty-eight hours. At last the tempest subsided, and we continued our voyage by night, I making my soundings by moonlight, with the aid of a lantern. Next morning the storm broke out afresh, and we again took refuge on a similar rocky islet. In the afternoon of the same day we once more started, but only just managed to reach the western shore, through having to battle for our very lives with a third tempest. We only just escaped being wrecked; and, utterly exhausted by our exertions, we slept that night on the desolate lake-side, and, after going for one day more, were seen by the men whom the leaders of my own caravan sent out in search of us. On my return to camp I was greeted by the Tibetans with shouts of joy. During my absence they had manifested the utmost uneasiness, and kept incessantly asking the Cossacks where I had gone to. The latter at length told them I had rowed to the southern side of the lake, had there procured horses, and ridden to Lhasa. Instantly they sent out patrols of fifteen to twenty men to ride round the lake, and even go on farther to the south. In the mean time I and Kutchuk were quietly smoking our pipes on the tiny islet in the middle of the lake. But now they were convinced I had *not* escaped them, their delight knew no bounds. They met me on horseback and conducted me in triumph to their tents, where, under the protection of their idols of Buddha, and in the light of their oil lamps, I was entertained in the most sumptuous manner.

At this juncture Hladyeh Tsering and Yunduk Tsering, and a great part of their mounted force, took their leave of us. Nevertheless there was still a considerable escort left, and these men remained with us all the way to the frontier of Ladak, although their numbers gradually dwindled, until by the middle of December there were only twelve men

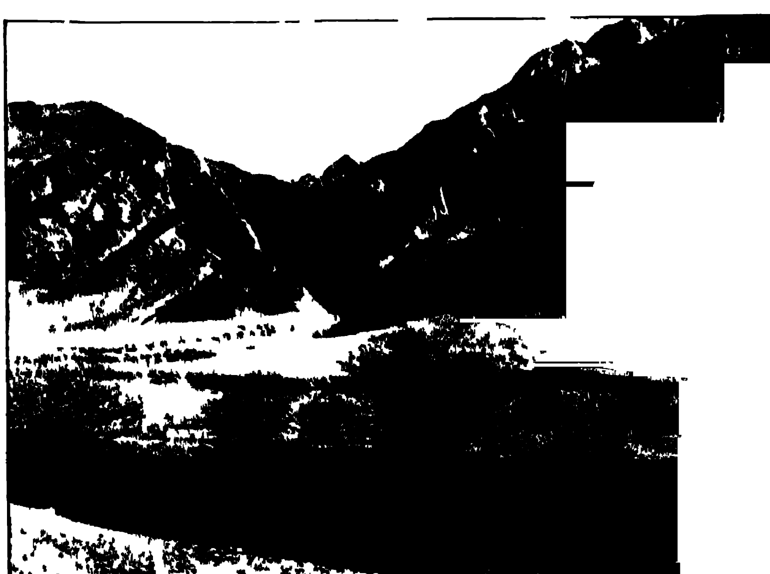
left. But by that time they were fully satisfied that I seriously meant to leave their country. Time, however, will not allow of my giving further particulars about this wearisome journey of three months' duration, right through Tibet from east to west. It was a time of severe trial for both man and beast. A strong west wind lay right in our teeth the whole of the time, and chilled us to the marrow with its icy blasts. The pasture was miserable in the extreme, and every day we lost camels or horses, or both; but, fortunately, the Dalai Lama had given orders that I should be kept supplied with as many yaks as I needed. As a rule we travelled between lofty mountain ranges, lakes grew less and less frequent, and the cold was intense. I also lost yet another of my men, making the fourth to die during this surpassingly trying journey.

By the middle of November there was scarce one-third left of the imposing caravan with which I started from the other side of the Arka-tagh. The country we travelled through was sparsely inhabited by nomad tribes; but we were everywhere received with friendliness and politeness, notwithstanding that almost the whole of Tibet was up in arms because of my attempt to reach the Holy City. I fear I must have caused them a fearful amount of trouble.

On November 19 the thermometer registered 48½ degrees of frost on the Fahrenheit scale. After crossing an uninhabited and almost waterless region, we reached, at the end of the month, the river Tsangarshar, and then followed it down as far as the temple-village of Noh, situated in a beautiful valley, thickly clothed with bushes and other vegetation, so that in the evenings we had magnificent fires to sit round. One day about this time we lost four out of our five surviving horses, and on another three camels.

After that we travelled for six days along the shores of Tsongombo, one of the most remarkable lakes I have ever seen. It resembles a Norwegian fjord, and is generally only a mile or two wide, though occasionally its width diminishes to less than a quarter of a mile, and in one or two places is actually not more than 20 or 30 yards wide. It is enclosed in a framework of steep and lofty mountains, and presents some magnificent scenery. As it was covered with a sheet of ice, I had to sound it from the frozen surface, over which I was drawn in an improvised sledge, made out of one of the halves of my collapsible boat. Our route took us along the northern shore. In one place the cliffs plunged down into the water so precipitously that it looked for a time as if we should be unable to proceed further. The pass which led over the mountain was impracticable for hoofed animals, and the lake was at this spot quite open water. But the extreme cold was an ally on our side. We had but to wait two or three days for the ice to thicken, and then we drew the baggage past the place of danger on an improvised sledge.

TSO-NGOMBO IN WESTERN TIBET



TSANGARSHAR RIVER IN WESTERN TIBET.

After that we skirted along the northern shore of Panggong-tso. This lake formerly belonged to the basin of the Indus, but is now cut off and divided from it by a low pass, which acts as a threshold. Consequently its water is at the present time slightly saline, and the lake free from ice. Its fresh-water molluscs are on the high-road to extinction. Its former beach-lines are, however, wonderfully well defined.

On the frontier of Ladak we found a large relief caravan, sent from Leh to meet us, and here the last of our Tibetan escort turned back home, after having performed their mission in a more than satisfactory way. Then, with two of the Cossacks to bear me company, I pushed on to Leh by forced marches over the passes of Dugub and Jimreh. The temple of Jimreh stands on a shelf, or high cliff, overlooking the valley of the Indus. Here the lamas had no secrets to preserve, but showed me everything, and even took me into the very holiest nooks of their shrines.

I spent my Christmas with the hospitable Herrnhut missionaries in Leh, and on January 1 I was on the road to Calcutta, in response to an invitation from Lord Curzon, Viceroy of India, whose acquaintance I made several years ago. This meant a journey of over 260 miles on horseback to Srinagar in Kashmir, and of another 200 by rail to Rawal Pindi. It was a hard ride, being the depth of winter, and led over the pass of Zoji-la, which is always dangerous, and at that season of the year generally quite impassable. My only companion was the Cossack Shagdur. We crossed the pass on foot, and all went well. The danger lies in the fact that the road leads through a sort of gorge, which is apt to be partly choked with falling avalanches. The tramp through the pass took us four days, and I had a hundred coolies to carry my baggage. It is really a great wonder we came out alive, considering how many of the native Ladakis lose their lives on this pass every year. Fortunately we managed to get over before it was definitively closed by the snow. When I returned from India the gorge contained a far greater quantity of snow. Then from Leh I journeyed on over the nasty pass of Kara-korum, some 19,200 feet above sea-level, where Dalgleish was murdered some years ago, and then struck down to Yarkand and Kashgar. Arrived there, I dissolved what remained of my caravan, and its members, Christian, Buddhist, and Mussulman, scattered to the four winds, each to his home in various parts of Europe and Asia.

Before the paper the PRESIDENT said: We have amongst us this evening our old friend and colleague, Dr. Sven Hedin. It is now five years since he was with us, and during that time he has done an amount of work as a traveller by which he has equalled himself—we cannot say more than that—in his former expedition, for which he received the Royal gold medal of our Society. But I consider that he has done much more than that. He has shown himself to be a scientific geographer of the very highest merit—as a linguist, an observer, and a historian. Our Council this

afternoon has considered the very great merits of Dr. Sven Hedin, and has decided to award him at once our Victoria medal instituted for the highest record in geographical research. I am glad to be able to announce this to Dr. Sven Hedin and to the meeting. I will say no more now, but will call upon Dr. Sven Hedin to address the meeting.

Dr. Sven Hedin: I have to begin by expressing my deep and sincere thanks for the very kind words which Sir Clements Markham has addressed to me, and for the great honour I am receiving in the Victoria medal, of which I am very proud, and of which I will try to be worthy in the future. I think it a great honour, also, to be invited to the Royal Geographical Society to address you once more; and I am very glad to hear Sir Clements Markham call me an old friend. I feel as an old friend here; not as a foreigner, but as an old colleague of the Royal Geographical Society. I have been in Central Asia for several years—it is a long time. I have not had much practice with your beautiful and charming language. If I am not able, during the description of my journey, to find the right words in the right places, perhaps somebody will help me, so that you may know what I mean. It is certainly not possible to give a detailed description of a journey which has taken three years and three days in an hour and a half; and I shall not be able to give the contents of the paper which is to be published in one of the next numbers of the *Journal*. I may tell you that I am writing a book about the journey, and this book will be published next year. The scientific results will be published three or four years afterwards.

Dr. Sven Hedin then proceeded to give a *résumé* of his paper, illustrated by over a hundred lantern-slides.

After the lecture, the President called upon Prince Kropotkin to speak.

Prince Kropotkin: It gives me great pleasure to comply with Sir Clements Markham's request to speak on the description of the journey which was made by Dr. Hedin in Central Asia. I can only say that I am delighted to add my voice to the many voices of praise which Dr. Sven Hedin must have heard all over Europe—viz. in Russia (where he lectured in Russian before a very large audience); in Germany; in his own mother country; and at last in England. This journey covered certainly ground that had been explored to a very great extent by Russian, French, and English travellers, and the journey which he undertook for reaching Lhasa he could not continue till its end. Like all other explorers, he was compelled, when he was almost, so to say, in sight of Lhasa, to return; whereupon he took the route to Ladakh, which had been followed once by Littledale. But the interest of his journey has not been lessened by the fact that he did not reach Lhasa. He was but a very few days' journey from that capital of Tibet, and he had crossed, during his attempts to penetrate as far as this capital, the most interesting parts of Northern Tibet. He crossed the great border ridge, Altyn-tagh, and also those immense chains of mountains where we find, as he remarks, almost the highest mountains of the world, at least as high as the Himalayas. Very probably Sven Hedin will change the direction of these mountains, which are shown on this large map (of the German General Staff) running west and east, and his surveys will surely very much alter the whole aspect of the country represented on this map. They will surely show to us that the mountains are running in directions from the north-west to the south-east, and when his determinations of altitudes are calculated, we shall see what tremendous plateaus he had to cross between the border range and the spot where he was turned back. As to his levelling in the Lob-nor desert, and the archæological discoveries which he has made in the country of Lob-nor, they will certainly throw new light on the changes which have been going on in the basin of this great Central

Asian lake. With regard to Lob-nor, I will permit myself to remark that I do not think that the lake Kara Koshun—that is, the Lob-nor of Prjevalsky—can be considered as anything else but the present remainder from the great lake Lob-nor. But what appears to me almost quite certain, after Sven Hedin's surveys, levellings, and discoveries, is that there was first a time when Lake Lob-nor covered the whole of the triangular space which is limited on the west by the southward course of the Tarim, on the south-east by the Lake Kara Koshun, and on the north-east by the escarpment of the Kuruk-tagh, which runs in a north-west to south-east direction. The place of the Sixty Springs, Altimish-bulak, which had been visited previously by the Russian explorers, and lies, according to their determinations, at an altitude of 3600 feet, stands on the border of the escarpment, and the triangular space between the escarpment, the Tarim river, and the plains which spread at the foot of the Altyn-tagh, must have been occupied some time by a large basin, upon the shores of which stood that spot of the Lau-lan region, in which Dr. Hedin has found such interesting manuscripts. Later on, the lake occupied the eastern part only of that triangular basin; and now the Lake Kara Koshun, or the Lob-nor of Prjevalsky, represents the southern trough of that depression, which continues still to be occupied by what has survived of the Lob-nor. At any rate, when the full reports and the levellings of Dr. Hedin are published, and the whole region is better explored, it will certainly appear that within this triangular depression ("Lob Nor desert" on Stieler's Atlas map) the lake was changing its position in proportion as it decreased, and it may change it several times more before the general desiccation of Central Asia, which is going on at great speed, will finally move the Tarim lake further south-westwards to meet the Cherchen, and finally reduce what will remain of the Lob-nor to the little lake Kara buran, which we see at the junction of the Yarkand-daria with the Cherchen. The journeys which Sven Hedin has made are certainly an event in the exploration of Central Asia; and we must only congratulate him, and express to him our warmest thanks, and the thanks of all the geographers of the world, for the remarkable journeys which he has made, for the accuracy of the description which he has given, and for the mass of information which we can expect from the publication of the full scientific report of this journey, and which will even surpass what we have found in the reports of his former journey published a few years ago.

The PRESIDENT: There are several other authorities present who might have addressed the meeting, but it is too late, I am afraid, to continue the discussion; therefore it only remains for us to acknowledge to Dr. Sven Hedin the great pleasure that we have derived from his admirable descriptions of the country he has traversed. He has, however, given us no adequate idea of the perils and hardships through which he went in collecting this information; nor has he given us any adequate idea of the diligence and care with which, day by day, he mapped the country and took regular and most valuable observations. He did not mention whether he suffered from being at great heights. I now gather from him that he never felt the sickness often experienced in the ascent of mountains. I asked him because I have just received a letter from Mr. Douglas Freshfield, who maintains that this feeling of sickness at great heights differs with individuals in the same way as sea-sickness differs with individuals. While some suffer very seriously, others at heights up to 20,000 feet do not feel the sickness at all. I gather from Dr. Sven Hedin that he is one of those who never suffered at all at great heights. Prince Kropotkin has so fully described to you the great importance of the work that has been done by Dr. Sven Hedin, that it is only necessary to allude to his discovery of ruins, and of the interesting manuscripts that were found in them; and to the care he took in levelling on the plain where the great lake once existed, to show you the vast geographical

and historical importance of the work that he has done. And those are only two instances out of many. I am sure, therefore, that the meeting will unanimously pass a vote of thanks to Dr. Sven Hedin for his most interesting communication.

Dr. SVEN HEDIN: I may once more express my hearty thanks for the great kindness shown to me this evening by the Council of the Royal Geographical Society, for the great honour bestowed upon me in the Victoria medal, which will be a great and precious souvenir of this evening. And I am very glad, also, to have almost heard how silent it has been in the hall during my lecture. I have got encouragement in the silence and the attention of the audience, and that is a most agreeable feeling for a lecturer. I hope I shall be able in the future to give more details about this journey. It was a very poor and short description I could give you now. I am very glad and happy to hear the kind and eloquent words addressed to me to-day by Sir Clements Markham, and the extremely kind opinion by Prince Kropotkin. I shall be very glad from this evening to keep those words in memory. I am sorry that any other Asiatic specialists who are present here did not get time to speak. It is probably too late, but I hope another time they will get an opportunity of talking about Central Asia.

The PRESIDENT: I may mention to the meeting that Dr. Sven Hedin is publishing his atlas, which will consist of two volumes of maps besides text, and I trust that the wealthier portion of our Fellows will subscribe to this most valuable and important geographical work.

NOTICES, FROM CHINESE SOURCES, ON THE ANCIENT KINGDOM OF LAU-LAN, OR SHEN-SHEN.

By GEORGE MACARTNEY, C.I.E.

IN his lecture delivered before the Royal Geographical Society on December 8 last, on his "Three Years' Exploration in Central Asia," Dr. Sven Hedin gave us a graphic description of the ruins of an ancient town on the border of the old Lob-nor. Amongst the finds brought home by him from this site were many Chinese manuscripts, which have been identified to be of the second and third centuries A.D. Some of these manuscripts bear not only the dates, but the name also of the locality where they were written. This name is Lau-lan, and the knowledge of this fact is one of special interest. The actual name of Lau-lan is well known to modern Chinese geographers, but hitherto, apparently, neither they nor savants in Europe have been able to fix with anything like accuracy the position of the country anciently called by that name. Mr. A. Wylie, a Chinese scholar of eminence, in 1880 had computed this position to be 39° 40' N. lat. and 94° 50' E. long. Now, this would show an error approximately of 250 miles if we are right in understanding that the place where Dr. Hedin found the Chinese manuscripts bearing the name of Lau-lan was in about 40° 40' N. lat. and 90° E. long. The more accurate localization of Lau-lan, now apparently possible, may, it is hoped, lead to some useful results in the identification of other neighbouring countries whose ancient names are known, but whose positions are still a puzzle to modern geographers.

If the Tsien Han-shu ('History of the First Hans') and the records left by Fa-Heen and Hsian-Tsang were consulted, we should find many places mentioned therein, with their distances given with reference to Lau-lan.

Thus, the Tsien Han-shu (written roughly between B.C. 100 and A.D. 50) mentions the following distances: From Wu-ni (capital of Lau-lan) to the Yang barrier (evidently in the direction of Tun-huang), 1600 li; to Chang-an, 6100 li; to the seat of government of the Chinese governor-general (name not given) in a north-westerly direction, 1785 li; to Si-an-fu, 1365 li; to Keu-sze (Onigour) in a north-westerly direction, 1890 li.

Fa-Heen (fifth century A.D.), in the record of his travels, gives the following distances: From Shen-shen or Lau-lan to Tun-huang, about 17 marches, 1500 li; to Wu-e (Urgur?), 15 marches on foot in a north-westerly direction.

From Hsian Tsang we learn that Lau-lan, which he also calls Na-po-po, is situated at 1000 li north-east of Chémo-tó-na, also called Nimo.

It will be seen from the above that the site Lau-lan can serve as a point of reference for determining the position of several other places. Perhaps the indications given above may prove to be of use to subsequent archæological surveyors.

But this is far from all that can be learnt about Lau-lan from Chinese records. The Tsien Han-shu tells us that China began intercourse with this country in the reign of the Emperor Wu-ti (B.C. 140–87), at whose time the western boundary of the empire would seem to have extended no further than the Yang barrier (possibly Tun Huang) and the Yu gate (modern Chia Yu Kuan?). The vast country lying beyond these places was designated by the Chinese geographers of the epoch under the vague term of Si-yu (western region), which they supposed to be divided into thirty-six different kingdoms. We are told there were two roads leading from China to this region. "That *viâ* Lau-lan, skirting the river Po (lower Tarim?), on the north of the Southern mountains (Altyn Ustun Tagh?), and leading west to Sa-chô (Yarkand) is the southern road. That by the Palace of the Anterior at Keu-tse (Onigour kingdom? 1890 li from Lau-lan), following the river Po in the direction of the Northern mountains (Tien Shan) as far as Su-lêh (Kashgar) is the northern road."

The watercourse in the Tarim basin is described in the following terms: "The river (Khotan Daria?) runs northwards till it joins a confluent from the Tsung-ling (Onion range, in Sarikol), and then flows eastwards into the Pú-cháng-hai (lit. Calamiferous lake), which is also called the Salt marsh. This is over 300 li from the Yu gate and the Yang barrier, and is 300 li in length and breadth. The water is stationary, neither increasing nor diminishing in summer or winter.

The river is then said to run underground and issue again at Tseih-shih, where it becomes the Yellow river of China."

The following is a *précis* of the account found in the Tsien Han-shu of the political relations between China and Lau-lan during the first century B.C.

The Emperor Wu-ti, we are told, was desirous of cultivating intercourse with Ta-wan and adjacent countries, and repeatedly sent ambassadors there. These had to pass through Lau-lan, but the people of Lau-lan, in concert with the Ku-tse, harassed the officials on the high-road, robbed and attacked Wang-Kuei, one of the envoys. Moreover, the Lau-lans made themselves objectionable to the Chinese by acting as spies for the Heun-nu (Huns), and on several occasions aided these in the pillage of Chinese travellers. All this was not to be tolerated. Wu-ti, therefore, prepared an expedition against the disaffected state. Chao Po-nu was sent with an army of 10,000 men to punish the Ku-tse, whilst the envoy Wang Kuei, who had suffered several times at the hands of the Lau-lans, received orders to act as Chao Po-nu's lieutenant. The latter, advancing at the head of 700 light horse, seized the King of Lau-lan, conquered the Ku-tse, and, relying on the prestige of his army, overawed the states dependent on Wu-sun and Ta-wan. The Lau-lans soon submitted, and sent offerings of tribute to the Emperor Wu-ti. But their submission gave offence to their allies, the Huns, who lost no time in attacking them. On this, by way of satisfying his two powerful neighbours, the King of Lau-lan sent one of his sons as hostage to the Huns, and another to the Emperor of China. Thus ended the first episode in the relations between China and the kingdom in question.

But more troubles were in store for Lau-lan. The Emperor Wu-ti, for some reason or other, had to send another punitive expedition against Ta-wan and the Huns. The Huns found the Chinese army so formidable that they deemed it prudent to avoid any direct encounter with it, but this did not prevent them from hiding troops in Lau-lan, the inhabitants of which did not cease to be in league with them. These troops constantly harassed the army of Wu-ti. The Chinese soon got wind of Lau-lan's secret coalition with the Huns, and accordingly the general, Jen-wan, was sent to chastise them. Jen-wan proceeded to the city gate, which was opened to him, and reproached the king for his treachery. The king, in excuse, replied, "When a small state lies between two great kingdoms, it must perforce make alliances with both, or it can have no peace; but now I wish to place my kingdom within the bounds of the Chinese empire." Confiding in these words, the emperor re-established him on the throne, and commissioned him to keep watch over the movements of the Huns.

This king died in B.C. 92. Then a question of succession arose. It will be remembered that one of the sons of the deceased king was a

hostage at the Chinese court. Now the Lau-lans made a petition to the emperor for the return of the hostage prince, in order that he might succeed to the vacant throne. The prince had not, however, been a *persona grata* with the emperor; in fact, all the time he was in China he had been kept in honourable confinement in the Silkworm House Palace. It therefore happened that the petition from Lau-lan was not favourably received by Wu-ti, but the answer returned was that of a diplomat. "I am tenderly attached," said Wu-ti, "to my attendant prince, and am loth to allow him to leave my side;" and the emperor suggested to the petitioners that they should install the next son of the deceased king in the royal dignity.

This the Lau-lans accordingly did. But the new king's reign was a short one, and on his death the question of succession again came to the front. This time the Huns, who, it will be remembered, had also a hostage prince from Lau-lan at their court, thought their opportunity had come to regain in that state the influence they had lost. They therefore sent the prince back and established him on the throne. This successful *coup* alarmed the Chinese, who endeavoured, by bribery and intrigue, to recover their ascendency. They made no direct attempt to dethrone the Hun's *protégé*, but sent an envoy to him requesting him to pay a visit to the Chinese court, where, the envoy said, liberal gifts would be bestowed on him by the emperor. But the emperor and the envoy little suspected that they had to reckon with a woman's cunning. The step-mother of the king was at hand, and she advised him, saying, "Your royal predecessor sent two sons as hostages to China; neither of them has ever come back, and is it reasonable that you should go?" The king thereupon dismissed the envoy with the words that, "having newly acceded to the throne, the affairs of the kingdom were engaging his attention, and that he could not attend the Chinese court before two years."

So far there had been no open hostility between the new king and the emperor, although, undoubtedly, relations between them were strained. But now the event which was to put an end to Lau-lan as an independent state was imminent. It appears that on the eastern border of Lau-lan, where this kingdom was continuous with China, there is a place called the Peh-lung mound. This place was on the high-road, *viâ* Lau-lan, from China to the western regions, and it suffered from drought and had no pasturage. The Lau-lans were frequently called upon by the Chinese to furnish guides, carry water and provisions to this spot for passing officials. In the discharge of these duties, the inhabitants were often exposed to the brutality of the Chinese soldiery. Friction was thus created; but the situation was made worse by the Huns, ever secretly instigating the Lau-lans against the Chinese. Finally, the Lau-lans resolved to break off friendly relations with Wu-ti, and forthwith murdered some of his envoys whilst passing through

Lau-lan territory. This act of treachery was reported to the Chinese court by the king's younger brother, Hui Tu-chi, who, having made his submission to the Han monarch, was scheming to oust his elder brother from the throne. Accordingly, in B.C. 77, the Chinese general, Fu-keae-tsu, was sent to put the king to death. Fu-keae-tsu hastily selected a few followers, and, having spread a report that he was going to a neighbouring state on a mission of friendly inquiry, and had presents with him for the king, he journeyed to Lau-lan. On Fu-keae-tsu's arrival, the king, who suspected nothing, invited him to a sumptuous feast. Whilst the king was intoxicated, Fu gave a signal to his followers, and the king was stabbed in the back. His head was severed from the body and suspended over the northern gate of the city. Hui Tu-chi, as a reward for his treachery, was set up as king in the place of his brother, and the kingdom was re-established under the new name of Shen-shen, for which a brevet of investiture was prepared. That nothing might be wanting to the prestige of the new ruler, one of the ladies of the imperial court was bestowed on him as consort, and on Hui Tu-chi leaving the Chinese capital for his kingdom, he was accorded a send-off marked with every honour. Thus was he established. But he did not feel himself secure in his new position. Being a Chinese *protégé*, he was looked upon with suspicion by the people over whom he had been called upon to rule. Moreover, the late king had left a son, and Hui Tu-chi lived in fear of assassination by him. Hui Tu-chi therefore petitioned the emperor to establish a military colony in Lau-lan, in the city of E tun, where, he said, the land was "rich and productive." This was done, and the emperor sent a cavalry leader with forty subordinates "to cultivate the fields at E-tun and soothe the people." Thus was the rule of the great Han monarch extended over the state of Lau-lan, or Shen-shen.

At the epoch when these chronicles were written, which, presumably, was about the time of the birth of Christ, the kingdom of Shen-shen, we are told, contained 1570 families, forming a population of 14,100, with 2912 trained troops.

On the physical features of the country, the Tsien Han-shu says (translation by Mr. A. Wylie)—

"The land is sandy and salt, and there are few cultivated fields. The country relies on the neighbouring kingdoms for cereals and agricultural products. The country produces jade, abundance of rushes, the tamaria, the *Clæcocca vermicifera*, and white grass. The people remove their cattle for pasturage wherever they can find sufficiency of water and herbage. They have asses, horses, and camels. They can fabricate military weapons, the same as the people of Tso-kiang."

So much, then, for the information contained in the Tsien Han-shu. Here is what Fa Heen says regarding Lau-lan, which he passed through in the fifth century A.D. on his way from China to India to

procure the sacred books of Buddhism. The translation is that of Dr. J. Legge—

"After travelling for seventeen days, a distance we may estimate of about 1500 li (from Tun-huang), the pilgrims reached the kingdom of Shen-shen, a country rugged and hilly, with a thin and barren soil. The clothes of the common people are coarse and like those woven in our land of Han, some wearing felt, and others serge or cloth of hair. The king professed our law, and there might be in the kingdom more than 4000 monks, who are all students of the hinayana (small vehicle of salvation). The common people of this and other kingdoms in this region, as well as the sramans (monks), all practice the rules of India, only the latter do so more exactly, and the former more loosely. Here the pilgrims stayed for about a month, and then proceeded on their journey, fifteen days' walking to the north-west bringing them to the country of Wu-e. In this there were more than 4000 monks, all students of the hinayana."

Hsian-Tsang (629–645 A.D.) passed through Lau-lan on his return from India, two centuries later than Fa-Heen, but his notice on this country is extremely meagre. We are merely told that, after leaving the walled but deserted town of Tche-mo-to-na, or Nimo, "he travelled 1000 li in a north-easterly direction, and reached Na-po-po, which is the same as Lau-lan."

RECENT VOLCANIC ERUPTIONS IN THE WEST INDIES.*

By Dr. TEMPEST ANDERSON.

It will be in the remembrance of every one present that in May, 1902, severe volcanic eruptions took place in St. Vincent and Martinique, both of which islands form part of the chain of the lesser Antilles in the West Indies. The Royal Society appointed a committee to investigate the eruptions, by whom I had the honour of being nominated along with Dr. J. S. Flett, Petrologist to the Geological Survey, to proceed to the scene of the eruptions and report to them. In our report, read before the Royal Society on November 20, we have already entered fully into the description and discussion of the phenomena observed; it will be better, therefore, in this paper to content myself with a *résumé* of the chief points, with special references to the geographical changes produced.

The islands of the lesser Antilles, from Saba on the north to Grenada on the south, form the summits of a chain of mountains about two-thirds submerged; for while their highest peaks reach eleva-

* Read at the Royal Geographical Society, January 12, 1903. Maps, p. 348. The descriptions of the plates will be found at the end of the paper.

tions of barely 5000 feet above sea-level, the depth of the Caribbean sea to the west is over 10,000 feet. They occupy the summit of a great fold of the Earth's crust, and are almost entirely volcanic, the chief exception being Antigua and a small portion of the eastern part of Guadeloupe, which, with Barbados, appears to form part of another fold more to the east, which is not volcanic. Other volcanoes occur on the mainland to the west of the Caribbean sea, one of which in Guatemala has also recently been in eruption. Earthquakes had taken place in the region surrounding the Caribbean sea during some months previously, and it has been concluded that the readjustments of the Earth's crust which gave rise to these have also been connected with the eruptions in St. Vincent and Martinique.

The island of St. Vincent is oval, the long diameter being nearly north and south. It is about 18 miles long and 11 miles wide. A mountain chain stretches along the main axis of the island, and reaches to a height varying from 2000 to 4000 feet, the highest point being just over 4000. It is entirely composed of volcanic materials, the beds dipping away from the central mass in all directions towards the sea. They consist chiefly of tuffs and agglomerates—in fact, fragmentary materials resembling those discharged from the Soufrière during the recent eruptions. Among them are many ejected blocks of enormous size, even as much as 20 or 30 feet in diameter, showing that some of the former eruptions must have been explosive like the late one, but on a grander scale. Lava-flows are comparatively few, but not entirely absent, and dykes are rare.

In the southern part of the island volcanic action has long been extinct or dormant, and we did not see any remains of craters, all such having apparently been removed by denudation. Towards the northern part of the island, however, is the great mass of the Soufrière mountain, in the summit of which is a crater of an almost circular form, about a mile in diameter. This, which is called the old crater, appears to have been the chief, if not the only, site of the recent eruption. On the north-east of the old crater, and only separated from it by a narrow ridge, is the so-called new crater, which was active in 1812. It is only about one-third of a mile in diameter, and it is doubtful whether it took any part in the last eruption. To the north of these craters, and partly encircling them, is an old crater-ring, which bears the same relation to them as Somma does to Vesuvius. The name Morne Garu was formerly applied indiscriminately to all this mountain range, but now has become restricted to a peak some distance to the south of the main crater, while the name Soufrière appears to be always given to the active cone.

To the south of the main craters, and between them and Morne Garu, a great depression or system of valleys extends right across the island. The eastern side of this is occupied by the Rabaka Dry river and

PLATE I.—TROPICAL VEGETATION. CHATEAU BELAIR, ST. VINCENT.

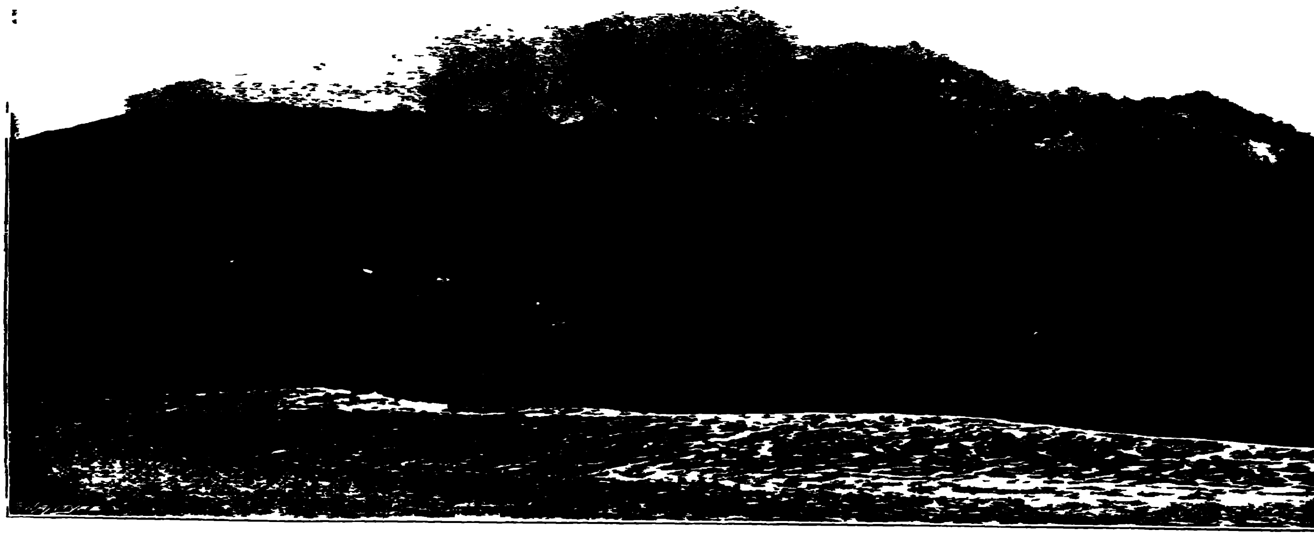


PLATE II.—THE WALLIBU DISTRICT FROM THE SEA

its tributaries, which drain into the sea on the windward coast north of George Town. The western, which is rather more extensive, is much eroded into deep valleys and ravines, often with almost precipitous sides, in which flow the rivers and torrents, which are often dry, and go by the names of Wallibu, Wallibu Dry river, Rozeau, Morne Ronde, and Larikai. The rocks of which this part of the mountain is composed are almost entirely tuffs and agglomerates formed of fragmentary material, similar to that ejected from the volcanoes during the recent eruption. We saw a few beds of lava, but they were chiefly exposed in the deeper parts of ravines, and were obviously of much older date than the more superficial portions. This great transverse valley, and especially its western portion, the valley of the Wallibu, received the greater part of the products of the eruption, amongst which we saw no lava, and do not believe any was erupted. A considerable number of ejected blocks * were noticed, but the great bulk of the material consisted of fine sand and ashes— in fact, lava blown to pieces by the sudden expansion of its imprisoned gases. The trade-wind blows steadily from the east or north-east, and a certain amount of the finer particles would be caught by the wind and deposited in the Wallibu valley. A considerable amount was also driven directly upwards so violently as to go through the whole thickness of the trade-wind and get caught by an upper current in the reverse direction, by which it was carried to the east as far as Barbados and the surrounding sea. A certain quantity fell on the north slopes of the volcano beyond the Somma ridge and along the east coast as far as to beyond George Town, but the greatest deposit which we saw, and in comparison with which all the others were trivial, was in the Rabaka and Wallibu valleys.

The tropical rains have cut deeply into the soft strata which form the cone of the Soufrière and the slopes at its foot, and have produced a series of branching valleys with steep or almost precipitous sides, and separated by the narrowest of ridges—in fact, often mere knife-edges. The whole, before the eruption, was clothed with the most luxuriant tropical vegetation. Into this series of valleys was discharged from the Soufrière a black cloud, so heavily laden with incandescent dust that it might most fitly be described as an incandescent avalanche. The mechanism of its production is discussed below, but its immediate geographical effect was to fill the Rabaka and Wallibu valleys and some of their tributaries to a depth in some places as great as 200 feet. The motion of the mass was sufficient to prevent any large amount of hot sand being deposited on the ridges, while the hollows received the greater part, and the whole was smoothed over by the blast, and lay in rolling masses like drifted snow. Thus in the course of a single

* The nature of these will form the subject of a special report to the Royal Society by my colleague, Dr. Flett.

day, or probably much less, the whole of the vegetation on this part of the mountain was utterly devastated, and the valleys were filled up with a deep new deposit of incandescent sand. This was the first and most obvious geographical alteration.

When we arrived on the scene a month later, secondary changes had taken place to a very marked extent. The wet season had set in in earnest, and as much as 5 inches of rain had been registered in one period of twenty-four hours. Denudation was taking place on a prodigious scale. The surface was everywhere scored with rain-furrows, which joined together in a sort of feather-pattern into larger streams, which had cut deep channels into the soft material; and these again united to form rivers, which in some cases had re-excavated the old channels, but in others had cut new and quite independent ones. The amount of denudation that had been accomplished in this short space of time seemed incredible to one accustomed to the leisurely rate of change in temperate climates. The Wallibu had excavated a new bed in the hot ash nearly 80 feet deep, and had left in places as many as five or six terraces to mark successive stages of its excavation, and the Rabaka on the east side had cut a corresponding gorge. Nor were the changes yet complete; we were fortunate in seeing them still in progress, and obtaining photographs of many of the most striking phenomena. When the weather was fine little change was to be seen, though the ash was still smoking, and hot enough in places even on the surface to burn the bare feet of our porters. Most of the river-beds were then also dry, but a brisk shower of rain changed all this. The water came down the rivers in torrents and undermined the steep banks. This started land-slides of hot ash, which fell into the river, and explosions of steam on an enormous scale took place. Showers of hot mud were thrown up to a height of perhaps 150 feet like great geysirs, and great clouds of steam, laden with brown dust, rose to a height of many hundred feet, and were carried away to sea by the trade-winds. Nor was this all: the fallen ashes often dammed the streams, and when the water at last overcame the obstruction it descended no longer as water, but as a gush of boiling-hot mud, which made the river-bed temporarily impassable, and built up alluvial fans at the mouth of the river. One day when we ascended the Soufrière, we crossed dry river-beds without difficulty in the morning when the weather was fine, but on returning in the afternoon, heavy rains having fallen in the mean time, a small river was full of boiling mud, and we were only able to cross it by the aid of a bridge which our men constructed of trees killed by the eruption, and this we saw carried away by a great gush of boiling mud soon after we had got over.

The spots from which these explosions had taken place, when sufficiently cooled to be approached safely, were also interesting. They formed bowls or funnels from perhaps 10 feet to 30 feet in diameter,

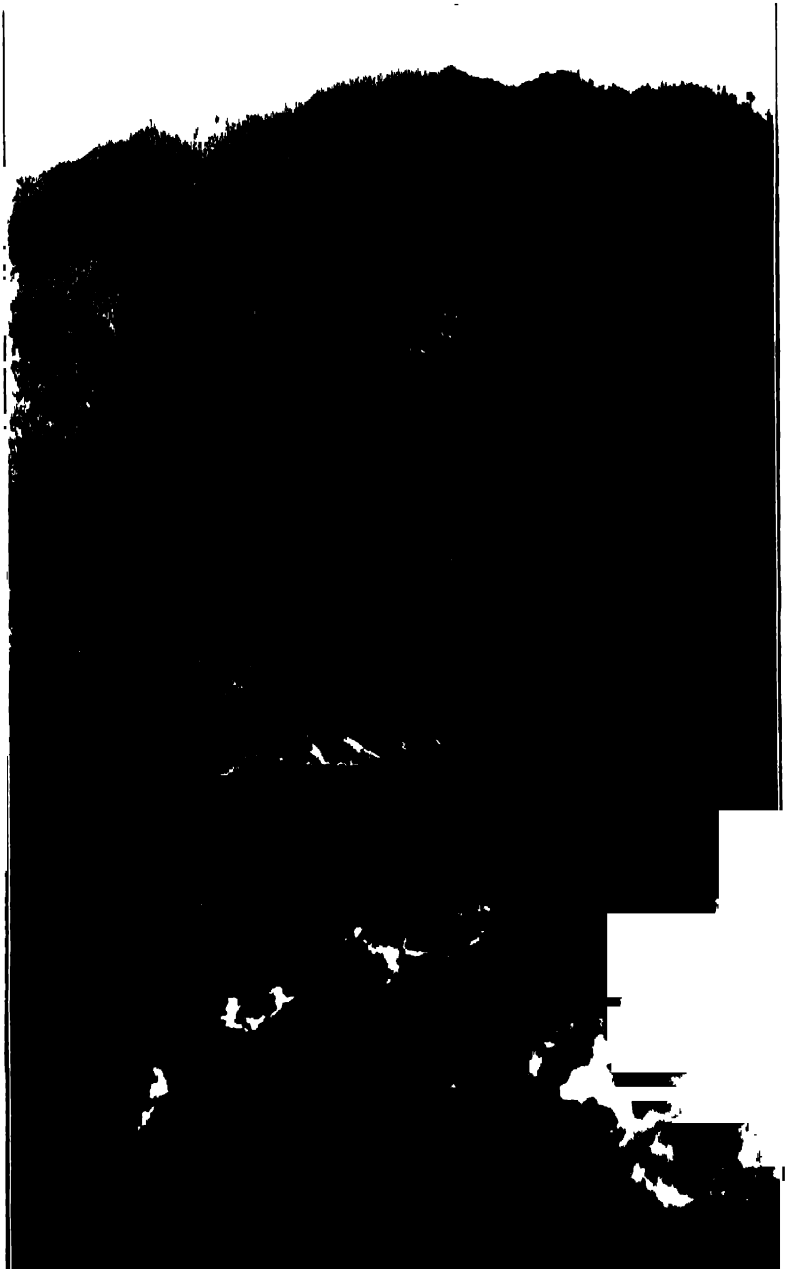


PLATE III.—IN THE WALLIBU VALLEY.

which, however, were seldom perfect, as one side had generally been removed by the stream as it cut its way deeper, and left the remains of the bowl standing as a depression in its bank. Surrounding the bowl was a low cone of *débris*, consisting of the stones and larger fragments which had been thrown up and fallen down around it, while the lighter sand was carried away by the wind. These new valleys, with their details—the terraces and steam-bowls and the associated fans and deltas—constitute another geographical change.

The shore deposits deserve a separate mention. On the windward coast especially, the amount of sand brought down by the streams had been so great that for 2 or 3 miles a new beach had been formed by the mud carried along the coast by the waves, where formerly the sea reached the foot of the cliffs; but this will no doubt eventually be washed away again.

We looked carefully for signs of general upheaval or depression of land, but without finding any. The rise and fall of the tide amounts to only about 2 feet, and the sea has made very definite marks along the face of the cliffs where they happen to be composed of lava or hard tuff. We were satisfied that no alteration of level more than a few inches could have taken place, and our boatmen, who knew the place well, were of the same opinion. There was, however, one very remarkable instance of a local subsidence which deserves notice.

At the mouth of the Wallibu valley, on the leeward side, extending from Richmond village on the south to Morne Ronde on the north, a distance of above a mile, there was formerly a low foreshore, along which ran the main road. It was described to us as having been covered with palm trees and luxuriant tropical growth, and studded with numerous picturesque villages, which nestled in beautiful little bays. Similar places still exist just outside the devastated area at Chateau Belair, Rose Bank, Barruali, and Layu.* Behind the foreshore the land rose in steep bluffs composed of fragmentary volcanic deposits like the rest of the Wallibu district. On the day of the great eruption the whole of this foreshore subsided into deep water, and as submarine slopes here are very steep, it is probable that the earthquakes connected with the eruption set up landslides, with the above results. It is possible that there may have previously been a fault along the line of the foot of the bluff, which determined the actual slip, and if this be so it might account for hot water rising here, which gave the name of Hot-waters to one spot; but, whatever be the exact cause, this subsidence is a geographical change worth mention.

The next geographical change noted was that the crater has been somewhat enlarged, especially at its southern lip, but not to any conspicuous extent; it has lost its clothing of vegetation, but this will

* The last beyond the map

soon be renewed, and its contained lake has been discharged, but it is already beginning to fill again. Any one who knew it before and visited it now would notice a considerable change, but, if he deferred his visit for a few years, would probably see no marked difference.

Another curious little secondary result deserves notice. Water will hold more mud in suspension when it is flowing down a steep slope. The water in the steeper upper parts of the valleys was charged with mud to the utmost, but where it descended on to more gentle slopes, and consequently moved more slowly, it could not carry so much, and deposited part, especially where it moved slowly at the side of the stream. We saw two places where dams had thus been formed across the mouths of small lateral valleys, and small lakes or large ponds had been produced. As the dams were only soft mud, these may only be temporary; but I have seen a permanent lake of several acres formed in this way in Iceland, by a bank of shingle brought down by a rapid glacial river. Dr. Flett thinks, and I agree that the explanation is feasible, that these lateral dams are the remains of the avalanche which filled the valley during the eruption, and that the centre part only has since been washed away.

A watercourse formerly existed which supplied all the plantations in the Carib country on the east or windward slope of the mountain with water taken from the Rabaka river high up. The river has now changed its course, and no water enters the conduit, which, moreover, in places is blocked up with ashes. This, however, can doubtless be remedied, but, as far as it goes, is a geographical change. The plantation buildings were not of sufficient size for their destruction to be of geographical importance, and the black population will, according to all previous experience, return after the cessation of the eruptions.

On the whole, the permanent geographical changes in St. Vincent are comparatively small. It remains to discuss the mechanism of the eruption; but this will be better considered along with that of Mont Pelée.

Turning now to the consideration of Martinique, I may remark that our instructions were to proceed first to St. Vincent and devote our chief attention to that island. This we did, but later on we went also to Martinique, for the purpose of making such an examination as would enable us to compare the phenomena of the two volcanoes.

There is remarkable similarity between the islands of St. Vincent and Martinique. Both are roughly oval in form, with the long axis almost north and south. The north-west portion of each is occupied by a volcano, the Soufrière and Mont Pelée, more strictly called Montagne Pelée, which have many points in common. Both volcanoes show a single or practically single vent, a remarkable absence of parasitic cones, and a scarcity of dykes. In both a transverse valley exists to the south of the volcanoes, and the main discharge of ejecta during

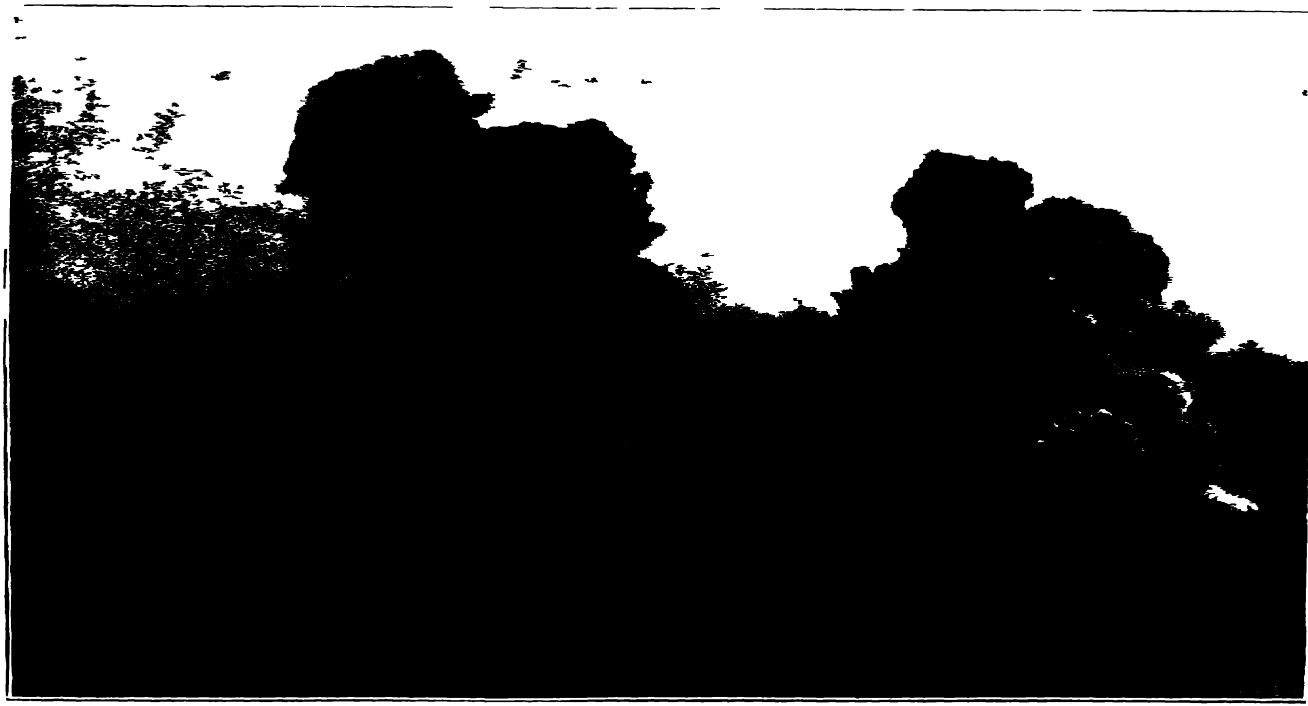


PLATE IV.—STEAM AND ASH EXPLOSIONS, WAITIBU

the recent eruptions, which have often been nearly synchronous, has been into this depression, and especially into its westerly portion. In both islands the recent eruptions have been characterized by paroxysmal discharges of incandescent ashes, with comparatively few larger fragments and a complete absence of lava.

There are, however, a few points of difference. The eruptions of St. Vincent have been altogether on a much larger scale than those in Martinique. The area devastated was considerably larger, the amount of ashes ejected probably ten times as great, and if the loss of life was not so large, this is accounted for by the absence of a populous city at the foot of the mountain. If such a city had existed at the mouth of the Wallibu river in St. Vincent in the position corresponding with that of St. Pierre, there can be no doubt that it would have been as completely destroyed as that unfortunate city. While both volcanoes show practically a single vent, this is much more marked in the case of St. Vincent, where excepting the new crater, which is really part of the old or main one, there is not a single parasitic cone. We saw no fumaroles, no hot springs, nor any trace of radial cracks and fissures.

On Mont Pelée, it is true, the main activity is confined to a restricted area about the summit of the mountain, and the top of the great fissure which extends or extended from this down in the direction of the Rivière Blanche; and there are no parasitic cones comparable, for instance, to those which are so numerous on Etna; but there are many fumaroles, which Prof. Lacroix and his colleagues speak of as emitting gases hot enough to melt lead, though not copper wire. A telegraph cable has been three times broken at about the same place, and the broken ends on one occasion, at any rate, showed marks of fusion of the insulating medium. There are also several hot springs. Judging from these and other indications, it is most probable that radial cracks entered deeply through the substance of the mountain, and penetrated even the submarine portion of its cone.

Flows of mud have also played a much more conspicuous part on Mont Pelée than in St. Vincent. Quite early in the eruption a great flow of this kind came down the Rivière Blanche and overwhelmed the Usine Guérin, which stood near its mouth, so that now nothing remains visible but the upper part of the chimney stack. It is probable that some at least of these mud-flows may have been due to the discharge of the small crater lake which existed before the eruption, or to heavy rains, the water in either case behaving in a manner comparable to what we saw in the Wallibu; but, at any rate, they occupy a more prominent part in the descriptions of these eruptions than in those of the Soufrière.

Not only has the amount of erupted material been much less, but its distribution has been much more local than in St. Vincent, and this is

accounted for by the great fissure at the top of the valley of the Rivière Blanche, which communicated with the main pipe of the volcano, and out of which the eruptions took place. This fissure, which was mentioned as existing in the eruption of 1851, pointed almost directly towards St. Pierre, and as the erupted material flowed out almost like a fluid, it was directed straight down on the doomed city. The lowest portion of the lip of the crater of the Soufrière was much broader and more even, so the incandescent avalanche which descended from it was spread much more widely.

The latest accounts from Prof. Lacroix indicate that the recent small eruptions of Mont Pelée have filled up the highest parts of the fissure and formed a cone, which covers up most of the former crater. In any further eruption, therefore, the avalanche of incandescent sand will not be confined to the district of the Rivière Blanche, but may descend on any side of the mountain.

Coming now to more strictly geographical details, it is wonderful how small have been the changes produced, smaller than even those in St. Vincent.

The north end of St. Pierre is completely buried in dust or levelled with the ground, so that nothing remains visible of the ruins of the houses except in certain protected situations, and the plateau rising to the north of the town towards the foot of the mountain is also covered. It is difficult to state the exact depth, but it is certainly inconsiderable in comparison with the 200 feet in the Rabaka, or even the 80 feet in the Wallibu. Further to the south, in the centre of the city of St. Pierre, the amount of ashes was much less; a great deal has been already washed away, but I doubt if it ever was more than 2 or 3 feet thick on an average, and on Morne d'Orange, at the south end, it was quite insignificant—only a few inches. The destruction of St. Pierre itself by the incandescent avalanche, and the hot blast and attendant conflagration, is an event of intense human interest as being attended by the sudden death of over 30,000 persons, but from the point of view of the physical geographer can hardly be called considerable, neither can the carrying away of a few small bridges, nor the formation of a small mud delta at the mouth of the Rivière Blanche.

It remains now to discuss the nature of these peculiar eruptions. They belong to a type which have hitherto been imperfectly, if at all, described, and we were fortunate enough to witness at a distance, at least as close as was safe, one of the characteristic eruptions of Mont Pelée, and thereby to confirm the views which we had previously formed by observation of the effects of those of the Soufrière.

On arrival at Fort de France we found that the devastated area to the north of the island was still almost entirely unoccupied. The greater part of the inhabitants of St. Pierre and the neighbourhood had been killed by the eruption, and the few survivors were only returning

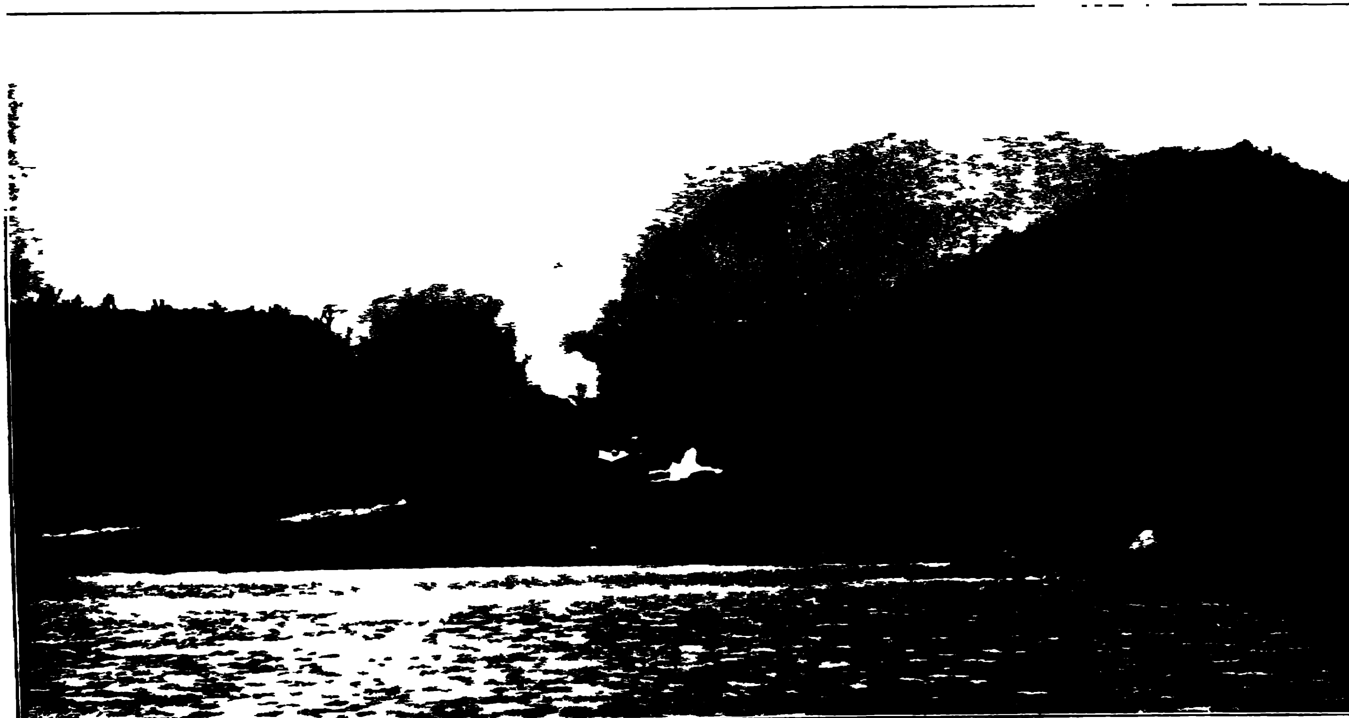


PLATE VI—THE MOUTH OF THE WAITIBU FROM THE SEA

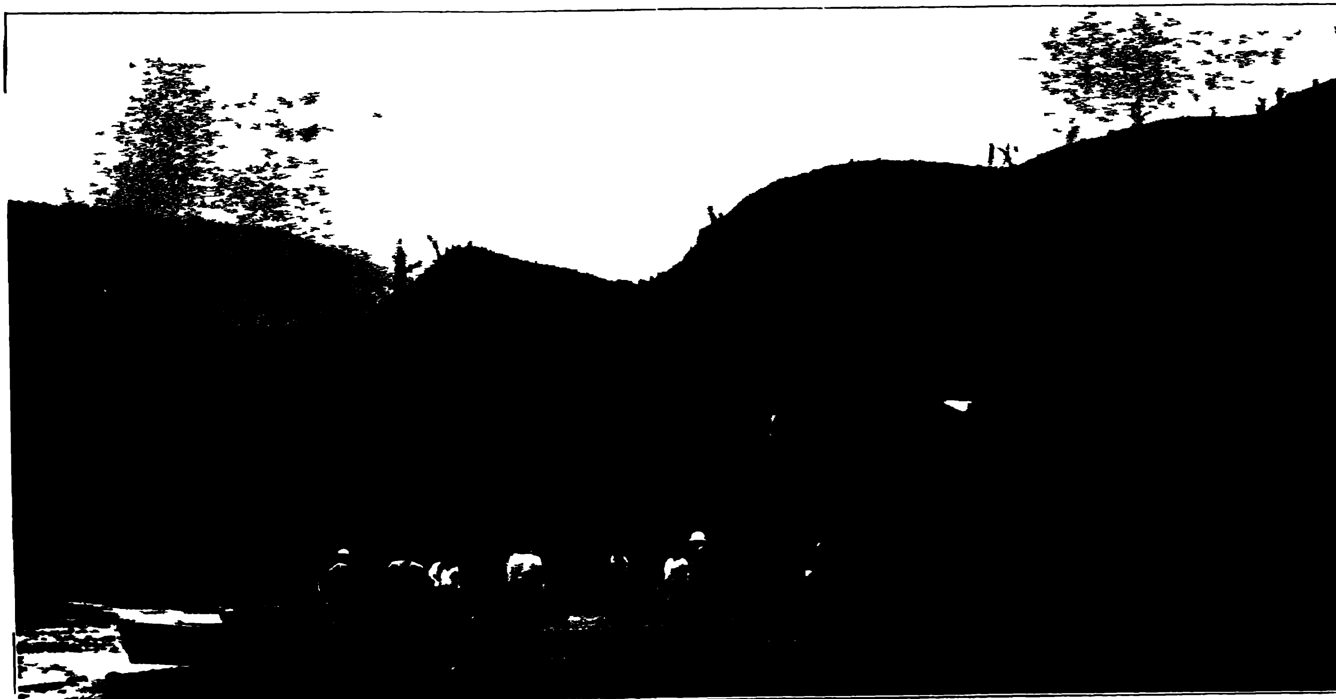


PLATE VII.—THE SITE OF THE WAITIBU SUBSIDENCE

by slow degrees. It was therefore impracticable to make our base of operations on land near the scene of eruption. Fort de France was too far away to be available, except at a ruinous expenditure of time and money in going to and fro. It was therefore determined to engage a sloop, provision it, and live on board, moving by day to any point where landing was desirable, and retiring at night to some safe anchorage within reasonable distance. We devoted our first day to an examination of the ruins of St. Pierre, and in the evening we moved about 2 miles south along the coast and spent the night at anchor off Carbet, just at the limit of the area of devastation, at a spot commanding a full view of the mountain. Next morning we returned to St. Pierre, and moored the sloop to one of the buoys at the north end of the town. Dr. Flett landed and further examined the ruins, while I remained on board and took photographs of the magnificent cauliflower masses of dust and steam which were frequently ejected from the great triangular fissure above mentioned. Later in the afternoon we sailed further north along the coast, still taking photographs of Mont Pelée, which was clearer that day than we ever saw it before or after, and showed to great perfection the deeply eroded valleys with which its slopes are scored. They much resemble those in corresponding position on the slopes of the Soufrière in St. Vincent, and appear to be formed in the same way in strata of similar composition, viz. fragmentary ejecta from the volcano which had consolidated to form soft tuffs, and had subsequently been eroded into their present forms by ordinary atmospheric agencies.

I have ventured thus to write in narrative form as leading up to the occurrences of that memorable evening. We returned and sailed slowly south past the base of the volcano, witnessing and photographing many small explosions and their cauliflower clouds of dust, and thus twice crossing the track of the eruption which took place later. We anchored as before off Carbet, and watched the sun set behind the clouds of ashes ejected by the volcano. When approaching the horizon and thus viewed, the sun appeared a sickly yellowish-green, and so pale that it could be looked at with the naked eye without discomfort. Later on, after sunset, the gorgeous after-glow appeared, and the thin clouds in the western sky were lit up with most brilliant red, beginning perhaps 30 or 40° from the horizon, while the part below still remained yellowish-green. Later still, as the sun sank further below the horizon, the yellowish-green area sank also, and only the reds remained, till they too sank out of sight, and gave place to the light of a brilliant three-days-old moon. We had sat on deck absorbed in watching this superb spectacle, and were just going to begin supper, when one of us, looking towards Pelée, said, "That cloud is different to the others. It's quite black, and I'm sure it's coming this way." A few moments' examination confirmed this, and, the captain's attention being called to it

we all, passengers and crew, heaved up the anchor as quickly as possible, and set all sail. The black cloud had meanwhile rolled down the side of the mountain on to the sea, and came quickly towards us. We had not moved a moment too soon. The upper slopes of the mountain cleared somewhat, and some big red-hot stones were thrown out; then I saw the triangular crack become red, and out of it poured a surging mass of incandescent material, reminding me of nothing so much as a big snow-avalanche in the Alps, but at a vastly different temperature. It was perfectly well defined, did not at all tend to rise like the previous cauliflowers, but flowed rapidly down the valley in the side of the mountain which had clearly been the track of previous eruptions, till in certainly less than two minutes it reached the sea, and was there lost to view behind the remains of the first black cloud, with which it appeared to coalesce. There and on the slopes of the mountain were doubtless deposited the greater part of the incandescent ash, while the steam and gases, with a certain portion of still entangled stones and ash, came forward in our direction as a black cloud, but with much greater rapidity than before. The sailors were now alarmed, nay, panic-stricken, got out the oars and pulled for their lives. Meanwhile the cloud came nearer and nearer; it was well defined, black, and opaque, formed of surging masses of the cauliflower type, each lobe rolling forward, but not all with one uniform rotation; bright scintillations appeared, some in the cloud itself, and some like little flashes of light vertically between the cloud and the sea on which it rested. These were clearly the phenomena described by the survivors in the St. Vincent eruption as "fire on the sea," occurring in the black cloud which overwhelmed the windward side of that island We examined them carefully, and are quite clear that they were electric discharges. The scintillations in the body of the cloud became less numerous and more defined, and gradually took the form of vivid flashes of forked lightning darting from one part of the cloud to another. The cloud rapidly gained on us. When it had got within perhaps half a mile or a mile—for it is difficult to estimate distances at sea and in a bad light —we could see small material falling out of it in sheets and festoons into the sea, while the onward motion seemed to be chiefly confined to the upper part, which then came over our heads and spread out in advance and around us, but left a layer of clear air in our immediate neighbourhood. It was ablaze all the time with electric discharges.

As soon as it got overhead stones began to fall on deck, some as big as a walnut, and we were relieved to find that they had parted with their heat and were quite cold. Then came small ashes and some little rain. Eventually we gained the harbour of Fort de France unhurt, and the proposed ascent of Mont Pelée next day, for which men had already been engaged, was abandoned. The cloud was also noticed at Fort de France. It was described as like those in the previous eruptions, but

PLATE VIII—A BEACH OUTSIDE THE DEVASTATED AREA

PLATE IX.—RIDGES ON THE SOUFRIERE

PLATE X.—LOT 14. A DEVASTATED PLANTATION

two unbiassed observers, who had seen it and that of May, declared this was the larger of the two.

Our limited time was now coming to an end, but on leaving for Dominica two days later we were able, from the deck of a steamer, to make some examination of the slopes of the mountain down which we had seen the incandescent avalanche descend. The whole district from just beyond St. Pierre to near Prêcheur, a distance of about 4 miles, was covered with a deposit of light grey ash of varying thickness, perhaps averaging a few inches, but evidently much deeper in the valleys of the Rivière Blanche and Rivière Seche, which descend from the mountain about 2 miles beyond St. Pierre, and drain the slopes below the large fissure out of which we saw the eruption descend. The water of these rivers was boiling as it fell into the sea—in fact, it was reproducing on a small scale the phenomena of boiling mud which are described above in the cases of the Wallibu and Rabaka rivers in St. Vincent, though how far up the mountain these Wallibu effects extend, and where they give place to true volcanic discharges, it is difficult to describe as yet; we must wait further observations by M. Lacroix and his colleagues.

Returning now to the mechanism of the hot blast and the source of the power which propelled it, both my colleague and I are convinced of the inadequacy of previous explanations, such as electricity, vortices, or explosions in passages pointing laterally and downwards, or explosions confined and directed down by the weight of the air above. Such passages into the mountain, which, to be effective, would require to be caverns closed above, and not mere open ravines, do not exist in the case of the Soufrière, and we are not aware that they have been observed in Mont Pelée; and as to the weight of the air, this did not prevent the explosions in the pipe of the Soufrière from projecting sand and ashes right through the whole thickness of the trade-winds till they were caught by the anti-trade current above and carried to Barbados. Moreover, the black cloud, as we saw it emerge from Mont Pelée, seemed to balance itself at the top of the mountain, start slowly to descend, and gather speed in its course, and the second incandescent discharge followed the same rule. We believe that the motive power for the descent was gravity, as in the case of any ordinary avalanche.

The accepted mechanism of a volcanic eruption is that a molten magma rises in the volcano chimney. It consists of fusible silicates and other more or less refractory minerals, sometimes already partly crystallized, and the whole highly charged with water and gases, which are kept absorbed in the liquid, partly by the immense pressure to which they are subjected. When the mass rises nearer the surface and the pressure is diminished, the water and gases expand into vapour and blow a certain portion of the more or less solidified materials to powder, or, short of this, form pumice stone, which is really solidified froth,

and they are violently discharged from the crater. When the greater part of the steam and gases has been discharged, the lava, still rising, finds a vent either over the lip of the crater, or often through a lateral fissure, and flows quietly down the side of the mountain.

It is quite recognized that these phenomena may occur in various relative proportions. The explosive phase may predominate, in which case only sand, pumice, and fragmentary material are discharged, with perhaps ejected blocks torn from the sides of the chimney, and in this case an ordinary ash or cinder cone is built up. On the other hand, the magma may contain little vapour, and the lava may be discharged quietly and spread out widely as a sheet over the surrounding country. The Snake river basalts in Western North America are of this class, and though they cover an area larger than England and France combined, no eruptive cones or craters have been found on them, and it is supposed that none ever existed, but that the lava welled out quietly through fissures. Such fissures I have seen in Iceland, studded with a row of quite small craters only. We believe that in these Pelean eruptions an intermediate phase occurs. The lava which rises in the chimney is charged with steam and gases, which explode as usual, but some of the explosions happen to have only just sufficient force to blow the mass to atoms and lift the greater part of it over the lip of the crater without distributing the whole widely in the air. The mixture of solid particles and incandescent gas behaves like a heavy liquid, and before these particles have time to subside the whole rolls down the side of the mountain under the influence of gravity, and consequently gathers speed and momentum as it goes. The heavy solid particles are gradually deposited, and the remaining steam and gases, thus relieved of their burden, are free to ascend, as was the case with the black cloud which rose over our heads on July 9.

We had concluded, from our examination of the Soufrière, that something of this sort must occur, but the explanation was obvious when we saw the eruption of Mont Pelée. Dr. Flett remembers my saying while the eruption continued, "That's an avalanche," and among my notes made while in the Indies are the following: "The cloud of incandescent material, as we saw it welling out of the great fissure, reminded us of nothing so much as a snow-avalanche as seen in the Alps. It rolled rapidly from the mountain-side in well-defined billows, giving the impression of a vast volume of separate small particles mixed with a certain quantity of air or vapour, and, as in the case of Alpine avalanches, entangling more air in its progress, and setting up a blast sufficient to overturn large objects in its course."

This effect of avalanches in compressing the air before them and setting up a powerful blast, the effects of which extend beyond the area covered by the fallen material, has long been recognized. Plate 13 shows a group of large trees overthrown by the blast of the great

PLATE XI.—THE MAIN STREET OF ST. PIERRE.

PLATE XII.—MONT PELEE IN ERUPTION

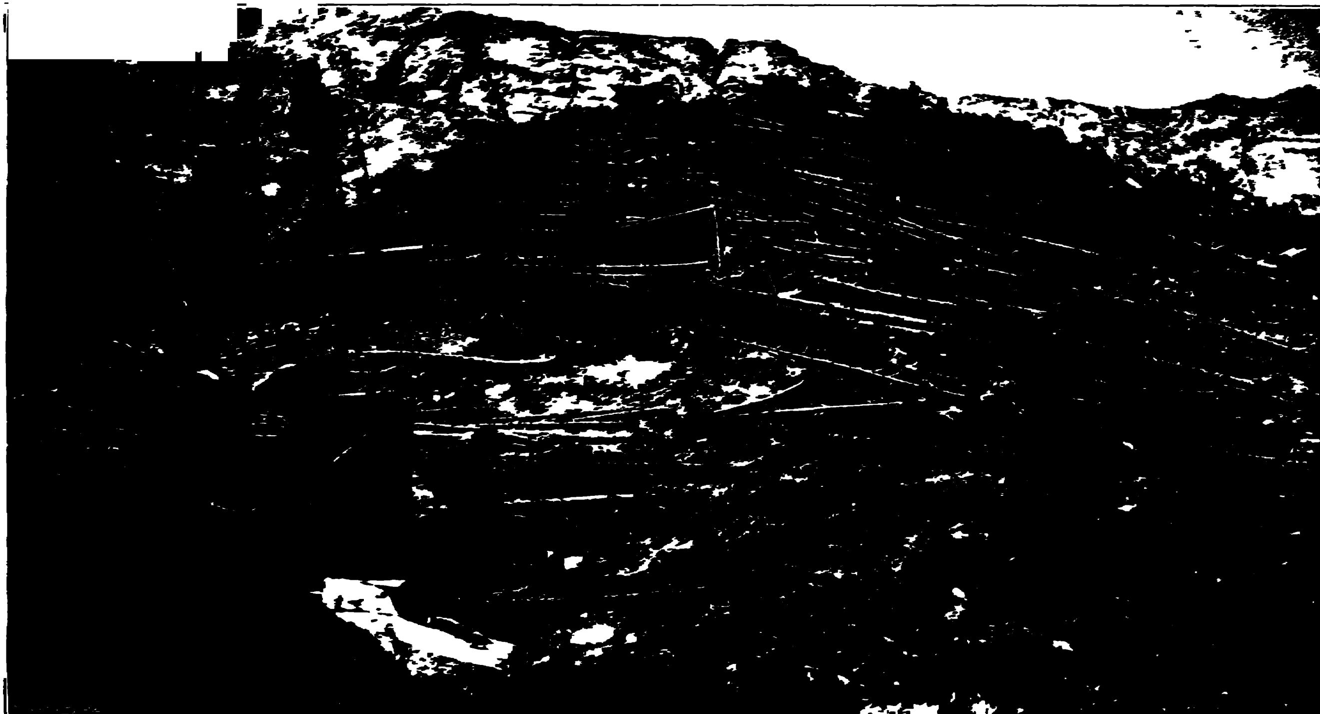


PLATE XIII.—TREES OVERTHROWN BY THE BLAST OF AN AVALANCHE

avalanche from the Altels on the Gemmi pass in 1895; all lay prostrate in directions radiating away from the place where the avalanche came down

The only difficulty which we felt as to the sufficiency of the above explanation was the fact that these discharges descended slopes of 10° and 12°, which are less than the angle of reposo for such material for instance, not so steep as the side of an ordinary railway embankment; but we thought that the entangled gases and steam might be sufficient to account for the extra mobility of the mass. When we brought this explanation before the Royal Society, it was accepted as satisfactory by the physicists present. Prof. Sylvanus Thompson, F.R.S., mentioned as confirmatory his having noticed that small particles of silica, when heated to redness, move about the crucible like a liquid; and Dr. Edward Divers, F.R.S., in a letter to *Nature*,* not only confirms this statement, but points out that the liquid-like behaviour of powders at a red heat is most marked in cases where gases or vapours are being given off in minute quantities by the incandescent particles, which are thus kept surrounded each by a thin envelope of mobile gas, and this exactly meets the case of the volcanic particles in question.

DESCRIPTION OF DR. TEMPEST ANDERSON'S PLATES.

These plates are all from photographs taken by Dr. Tempest Anderson.

PLATE I.

Tropical Vegetation. Chateau Belair, St. Vincent.

This view, taken about 2 miles beyond the southern boundary of the devastated area, shows the luxuriant character of the tropical vegetation which formerly covered the whole district. The hut is of the usual type occupied by negroes, the descendants of liberated slaves. It consists of wooden uprights, walls of wattles, now generally giving place to boards, and a "trash" roof.

PLATE II.

The Wallibu District from the Sea.

In the distance is Morne Garu; in the middle distance the hot sand deposited by the eruption. The rolling, rounded character of the surface is shown, also the furrows and gullies already cut by the rain. The foreshore which formerly existed here has sunk into deep water, and the waves are cutting into the bluffs behind, and have exposed a section of the new ash resting on the old beds of fragmentary volcanic material A new beach is in process of formation.

PLATE III.

In the Wallibu Valley.

In the distance are the slopes of Morne Garu, with trees killed by the eruption; in the foreground terraces of hot sand, marking the level to which the valley was originally filled, and some of the successive stages of its re-excavation. The hot sand is still steaming wherever water comes in contact with it.

* *Nature*, December 11, 1902, p. 126.

PLATE IV.

Steam and Ash Explosions, Wallibu.

This photograph was taken from above Chateau Belair, a distance of about 2 miles across the bay. In the foreground are the two ridges which saved the village during the eruption. Beyond them are seen the great clouds of steam and ash or sand, which were only visible after rain. The Soufrière mountain would be visible were it not concealed by the clouds.

PLATE V.

Rozeau Dry River flowing with Boiling Mud.

In the background are beds of new hot sand only a few feet thick, and already much washed into furrows by the rain, which is even cutting into the old banks. In the foreground, extending to just below the bridge, is a gush of hot mud as described on p. 268.

PLATE VI.

The Mouth of the Wallibu from the Sea.

Morne Garu is seen in the distance, and in the foreground the now alluvial fan of sand brought down by the river; in the middle distance is a small steam explosion.

PLATE VII.

The Site of the Wallibu Subsidence.

The low cliffs in the middle distance consist of old tuffs with a capping of several feet of fresh sand, the product of this eruption. On the top are seen the ruins of the Wallibu factory, and at the foot was formerly a foreshore, perhaps 200 yards wide, on which were the high-road and a number of negro huts standing among luxuriant vegetation. The whole subsided on the day of the eruption. The new beach in the foreground has been formed since that time (in about a month) of material washed from the cliffs and brought down by the rivers. The Soufrière is seen in the extreme distance to the left.

PLATE VIII.

A Beach outside the Devastated Area.

This is introduced for the purpose of comparison, to show the sort of place that existed before the eruption on the site of the last photograph.

PLATE IX.

Ridges on the Soufrière.

This plate shows the ridges of tuff on the lower slopes of the mountain on the windward side above Lot 14. Those on the leeward side are similar. Higher up the slopes become steeper, the ridges narrower, and the gullies between them deeper. The whole was formerly covered with luxuriant vegetation, of which a few charred remnants are seen. In the distance are the hills above George Town, and in front of them the Rabaka Dry River, with one of its branches in the foreground to the right.

PLATE X.

Lot 14. A Devastated Plantation.

This was the highest plantation on the windward side along the old Carib track which led to the summit of the Soufrière. The trees are charred and stripped of their leaves. The factory is unroofed, the machinery wrecked, and the waterwheel damaged. Much sand is about.

PLATE XI.

The Main Street of St. Pierre.

This photograph shows the condition of St Pierre on July 8, about two months after the main eruption. The iron beam and masonry columns is all that remains of one of the principal shops. In the distance is part of the north tower of the cathedral still standing; the main part of the building is destroyed

PLATE XII.

Mont Pelée in Eruption.

This photograph, taken on the afternoon of July 9, gives an excellent idea of the great black cloud which so nearly overtook us later in the evening, and which I was unable to photograph from absence of light

PLATE XIII.

Trees overthrown by the Blast of an Avalanche.

A great avalanche descended from the Altels mountain on the Gemmi pass, in Switzerland, in September, 1895. At the end of an unusually long hot summer, a large portion of the Altels glacier and snow-field slid down bodily, and carried with it a quantity of stones and *débris*. The avalanche covered an area of above a square kilometre, and killed several men and above 100 cattle. The Altels is beyond the right of the plate, and the trees which were outside the area covered by the avalanche itself were overthrown by the blast of air which accompanied it. They all point radially away from the Altels. A few to the left were protected by the hillock, and escaped.

In opening the meeting, the PRESIDENT made the following remarks. The meeting is probably aware that the Royal Society commissioned two scientific gentlemen, Dr. Tempest Anderson and Dr. Flett, to proceed to the West Indies and investigate the causes and effects of the recent volcanic eruptions in St. Vincent and Martinique. They have already reported to the Royal Society, but Dr. Tempest Anderson has been so good as to prepare a paper for us, mainly treating the subject from a geographical point of view, with regard to the geographical effects of the eruptions. I will now ask Dr. Tempest Anderson to address the meeting.

After the reading of the paper, the following discussion took place :—

Dr. FLETT: Dr. Tempest Anderson has asked me to say a few words to you regarding the map of the Caribbean region, and regarding the nature of the geographical changes which have taken place in St. Vincent and Martinique. Some of you have already seen this map. It shows the chain of volcanoes of the Antilles, and those which are at present in eruption. We had in Guatemala, in April, a very powerful earthquake, and since we have had volcanic eruptions which have devastated a considerable part of that country. The photographs Dr. Tempest Anderson has shown will explain the nature of the geographical changes which had taken place in St. Vincent before we got there. But you must remember that, since we left, important eruptions have taken place, and changes are going on in that country at an almost unexampled rate. Vast quantities of material are poured out of the volcanoes in the course of a few hours, and then with great rapidity the tropical rains wash them into the sea. There has been considerable devastation since we were there, and the whole north end of Martinique has, by the order of the governor, been recently evacuated. French scientific men are now resident in

Martinique, and they have erected an observatory a little west of Carbet, from which the changes in the mountain are constantly recorded. We have many correspondents, including Mr. McDonald, Mr. Powell, Major Hodder, and many others, in St. Vincent and St. Lucia, and they have sent letters and photographs which show the nature of the changes that are going on. There was a great eruption in St. Vincent on October 15, and there was another in November. Since then the crater has been visited, and it was found that the lakes were replaced by masses of sand. The crater has been somewhat enlarged. The water gathering within the crater has now converted it into a lake of boiling mud. The most remarkable change on Pelée is that recently described by Prof. Lacroix, of the French Scientific Commission. I have had letters from St. Lucia describing the gradual growth of a new volcanic cone, which got higher every day and finally overtopped the rim of the crater. When we were there we could see that cone, coated apparently with large stones, in the fissure which faces the harbour of St. Pierre, and at night the cone could be seen to be red hot. Prof. Lacroix and the French scientists have been there again within the last few weeks, and they find that this new cone, which is building itself up within the crater, has a most remarkable structure; it seems to be a pillar of solid lava. Every now and then pieces break off from the surface, and then they roll down into the interior of the crater floor, and expose the bright red surface of the lava column. This shows that the volcanic magma within the volcano of Martinique is highly viscous, and, in fact, has nearly consolidated. So that, in addition to the strange black cloud, we have this curious block of lava, which has risen right up in the centre of the old crater pit to a height of at least 900 feet.

Prof. BONNEY: I am sure you will all agree that the Royal Society was particularly fortunate in the two gentlemen whom it obtained as its commissioners. Dr. Tempest Anderson not only, as you have seen, is a most admirable photographer, but I suppose he has made a greater number of clinical examinations of volcanoes than any other man. Again, he helped to remove one very serious difficulty that every scientific society feels—that is to say, the question of expense—and he did this by volunteering most liberally to go at his own charges. Again, it was great good fortune obtaining the services of Dr. Flett, because he has already made a reputation among petrologists that any man twice his age might be happy to have won. These eruptions are not only of great pathos, but also of great scientific interest. We have heard, from what Dr. Tempest Anderson and Dr. Flett have said, that they teach us one very great lesson, and that is how much more rapidly sometimes both accumulation and denudation, and particularly denudation of loose materials, may be carried on. That is a valuable lesson, because perhaps in this easy-going country we are apt to fall into habits of thought which are too monotonous. I am not quite sure whether some of our English geologists are not sometimes too strictly uniformitarian. Perhaps some of you have been to the Brohl-thal, and, if so, you will remember the masses of trass partly choking up the valley. I have always been puzzled to know how any ordinary flood could have brought the deposit there. This may have come down as the volcanic mud came down the Rabaka river, and have been to a large extent cleaned away again. Besides that, there are points that were only touched upon. I hoped that we should have heard something more from Dr. Flett this evening of the peculiar character of that explosive avalanche. He thinks—and it appears to me the best explanation offered—it is due to the crystallization of a number of minute minerals in the molten stuff, which was already rather saturated with superheated water. In the process of crystallization the water is thrown, as it were, out of the mineral as it forms. Now, if one-third of a mass of magma crystallizes, there will

be in the remaining part just half as much water as there was before, so that if the material then had the pressure diminished, the water would begin to separate as a gas. These little crystals scattered throughout the mass would make every one a locus, as it were, of unequal resistance. Therefore, instead of getting a stony froth as you had in the uniform Krakatoa magma, you would get this stuff constantly exploding. It would just go shattering up as it left the volcano like a self-exploding shell. That, I believe, is Dr. Flett's explanation, and I believe it is the true one. Then he pointed out there were other explosions of the volcanoes around the Caribbean sea. That is a most fascinating question, but I am quite sure that, at this late hour of the evening, if I were listening to myself I should be very glad when I stopped, therefore I shall be tolerant and say no more upon the question, for if I began I do not know when I should end.

Prof. JUDD: I am sure that I may make the same apology that the preceding speaker has done, and that at this late hour little need be said. But I cannot sit down without calling attention, not to the important scientific details, which would take up too much time, but to remind you of those beautiful illustrations that we have had put before us by the art of photography. Those of us who have tried to study volcanic phenomena in the pre-photographic days will remember that even the most beautiful illustrations published—even those of Sir William Hamilton—must always impress us as possibly being wanting in truthfulness. The great artist, in the presence of those great convulsions of Nature, cannot but be led astray, and we welcome the truthful representations which the photographer gives us, which are more accurate than those of any artist can possibly be. I believe it was during the eruption of Vesuvius in 1872 that photography was first applied to record volcanic phenomena. Since that time much has been done. But the best of all that has been done, I think I may say, without fear of my opinion being challenged by any one,—the best of all has been done by Dr. Tempest Anderson, who has visited almost every accessible district with his camera. How successful he has been, how ably he has done his work, the pictures we have all looked upon with so much pleasure to-night have fully illustrated. The work that he has done has been so important indeed, that I cannot conceive it can ever be surpassed until, if not Dr. Tempest Anderson himself, his successor should bring to this room a succession of pictures taken at intervals of a few minutes, and then we, by the aid of the cinematograph, we could sit in a room like the present and have the whole volcanic eruption passed before us from beginning to end.

Prof. MILNE: At this late hour, the best thing I can do is hardly to say anything at all. There are so many points that one would like to talk about, and if one begins one does not know where one would end. I think there is one thing about which we are all agreed from what we have seen and heard, and that is, during the business hours of a volcano never call upon it.

The PRESIDENT: It remains for the meeting to pass a vote of thanks to Dr. Tempest Anderson for his most valuable paper so beautifully illustrated, and to Dr. Flett for the additional information of very great interest that he has given us. I propose, therefore, that we accord to Dr. Tempest Anderson and Dr. Flett a very hearty vote of thanks.

Dr. TEMPEST ANDERSON: Allow me to thank you for the kind vote of thanks you have just passed to me. Before I started, one of my friends remarked to me, 'You know, Anderson, you are sure to be killed, but it will be such a very great satisfaction to you afterwards to think that it was in the cause of science."

TWO TRIPS TO THE NORTH OF CHENG-TU.

By R. LOCKHART JACK.

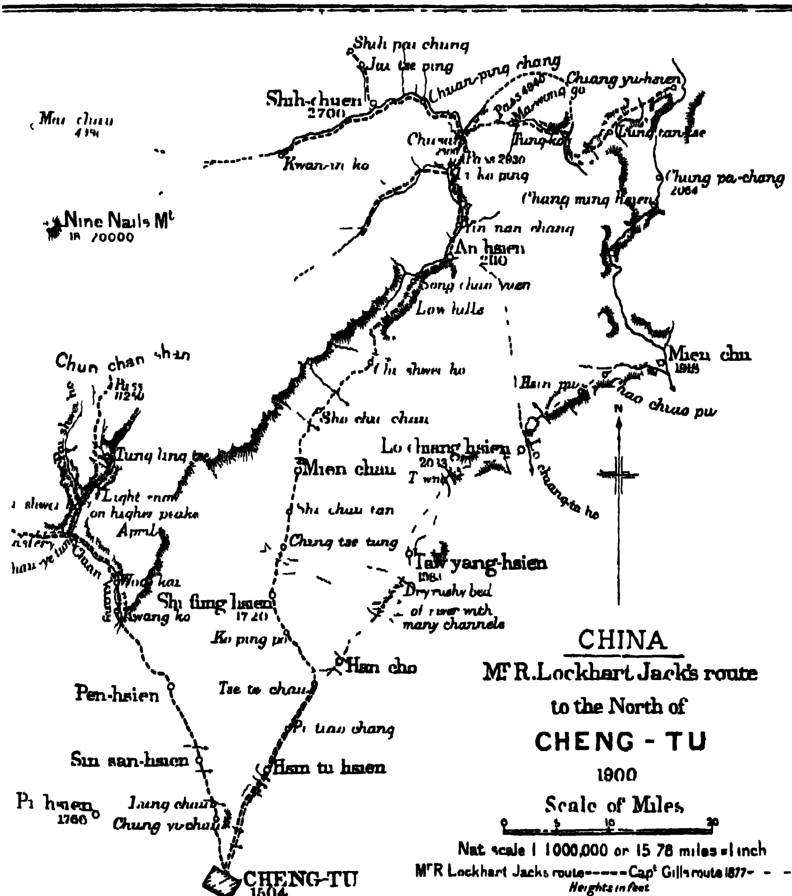
In March, 1900, Dr. Jack, accompanied by J. F. Morris and myself, reached Cheng-tu by way of Shanghai and Chungking, to inquire into the mineral resources of Sechuan on behalf of an English company. From Cheng-tu as a centre we made three trips before we were compelled by the Boxer troubles to leave the country, and I propose to give a short account and route traverse of those portions of the two northern trips that do not appear to have been previously mapped, though some of the country has been already visited and no doubt described by missionaries. The first was to the north-north-west from Cheng-tu, through Pen-hsien to the monastery of Tung-ling-tse, while the second was a deviation from the round trip by Sungpan, mapped by Captain Gill in 1877.

In presenting the accompanying map I cannot lay claim to any great accuracy, as my instruments consisted of a pocket compass, a watch (picked up in Cheng-tu), and an aneroid, but the absence of any previous traverse (to the best of my belief) is my excuse. The map is of interest as showing a portion of a little-known district, and delimiting approximately the north-western boundary of that area of intense cultivation, the Cheng-tu Plain.

Cheng-tu, our base, is the capital of the province, and is situated at the centre of the plain to which it gives its name. It was first made known to Europeans through the description by that famous Venetian Marco Polo, who describes its wealth, and also speaks of a "great river a good half-mile wide." The city is still great and rich, but the river has sadly dwindled, being probably the Min, which has been split up for irrigation purposes, whenever it debouches on the plain at Kwan-hsien. The city is surrounded by a moat (now dry and under cultivation), and a wall about 30 feet high, of earth faced with brick, enclosing an area of about 12 square miles, and its population is probably from 500,000 to 800,000. Its main streets are broad (about 30 feet), well paved with flags, and very free from the unpleasant odours so characteristic of most Chinese towns. Many of them are roofed with mats, and flanked by shops wherein silks and many articles of foreign manufacture, such as cottons, kerosine, Swiss milk, glass-ware, and other commodities of Western origin, are exposed for sale. Silk is very largely woven in the city. Mr. G. J. L. Litton states that over 3000 looms are employed in the manufacture of crepes, satins, brocades, etc., and the product appears to be very good and cheap.

Wheel traffic in Sechuan is non-existent as far as I could learn, except in this city and the surrounding plain, where wheel-barrows and crude 'rickshaws are to be found; both of these are used by the

poorer classes as aids to locomotion, but the gentry invariably travel in Sedan chairs, often accompanied by a retinue, bearing banners and gongs, that does not lend dignity in a Westerner's eyes, as it is made up by impressing the loafers and beggars who congregate at the door of every yamen.



Over fifty persons, attached to the various missions, compose the European population, and their hospitality and semi-European homes form a welcome break in the monotony of an everlasting sea of yellow faces and blue gowns. In addition, one of the missions maintains a very serviceable hospital of about twenty beds, which I believe is much resorted to by the Chinese. Finally, a home-like touch is given by the

steam-whistle of the Arsenal, an establishment employing over 600 hands, and containing much fine machinery, some of it built locally. However, it is not employed to the best advantage, as Hotchkiss guns and Martini rifles are being turned out side by side with matchlocks and other weird and wonderful lethal weapons.

On April 3 we set out for Tung-ling-tse, after engaging carriers through a "coolie hong," an association that contracts for all carriage, and is, through its overseers, responsible for the safety of property under their charge. I may say that, after warning our personal "boys" that they would be held responsible for any discrepancies between the stores issued and used, we did not, in several months' travel, lose a single article, although most of our things were carried in unlocked baskets. As each man carries about 80 lbs., for light travelling, and the etiquette of China ordains that a foreigner must travel in or with an eight-bearer chair, such as is used by officialdom, if he wishes to be in touch with the officials of the country, the cavalcade was an imposing one. Further dignity was given to it by the presence of a Waiyuan, or magistrate, red umbrella and all, whom the Viceroy ordered to accompany us, and by a proclamation from the Viceroy, Mining Commissioner and Tartar General, which enjoined the populace to be respectful to "the strangers from afar," and which was posted on the official notice-boards ahead of us.

After leaving Cheng-tu by the north gate, we proceeded north-north-west over a plain seamed with irrigation channels, and covered with pretty farms and numerous villages and towns. Although the roads are crooked, ill paved, and ofttimes boggy, the streams are invariably spanned by structures ranging from a flat stone slab to imposing covered bridges of wood and masonry. Single-arch bridges are frequently met with, built of spheroidal boulders held in place by their own weight, without mortar of any description. Similar structures carry small mill-houses, in which grinding stones 2 or 3 feet in diameter are actuated by an open turbine, driven by a stream of water flowing down an inclined trough and impinging on the vanes. For irrigation —and irrigation is universal—the streams are subdivided in a marvellous manner, and where the water cannot be led by gravitation, either the Chinese chain-pump is used, or, if 2 or 3 inches of head can be obtained, large undershot water-wheels slowly and noisily revolve, and raise the water to the higher levels in buckets cut from a length of bamboo and affixed to the periphery.

Our first day's march of 29 miles by road brought us to the walled city of Pen-hsien, which, as we were informed by its magistrate, boasts an intramural population of 60,000, and a like number outside the walls. We were fortunate in securing a large and cleanly hotel, poetically known as the "Propitious Star," with a handsome garden at the back of the official room. It may be mentioned that there is an inn in

almost every village, or, failing that, a temple, where every traveller, down to the humblest coolie, repairs nightly, and for a fraction of a penny obtains a wadded quilt from the hotel office, and the right to a straw pallet, a bunk, and hot water. Food also is obtainable at reasonable rates, and in too many of them dirt and other plagues are also to be had gratis.

Our next day's route was across the plain to the north-west till noon, where we reached the hills at Kwang-ko. Kwang-ko we found to be a small straggling village, chiefly remarkable as the head of a very complete system of irrigation canals. The Chian-kiang, a river about the size of the Tay, flows over a long weir which seems to serve the purpose of distributing it evenly into four channels, which immediately diverge and serve that portion of the plain too high to be reached by the waters of the Min, which are similarly split 22 miles to the west-south-west at Kwan-hsien. A little above the village we crossed from the right to the left bank over a handsome five-span suspension bridge of bamboo cables carried on masonry piers. Some miles higher we recrossed, this time over a bridge of plank carried on piers of bamboo wickerwork cylinders filled with shingle, and stopped in the village of Shau-ye-tung. The river flats over which we travelled were for the most part very densely populated and closely cultivated. On the east high mountains were visible carrying a light powdering of snow. Subsequently we met with traces of snow at 7000 feet, but it was not met with in any quantity below 8000 feet, at which height at least I am inclined to estimate this range.

Arriving at Tung-ling-tse monastery (3900 feet), we made it our headquarters while we looked at various mining shows in the neighbourhood. We were obliged, for want of accommodation, to camp in tents, as our men filled the temple. Tents, though a very great improvement upon the general run of hotels, unfortunately cannot be used much in the densely populated districts, where the sub-aqueous cultivation of rice leaves no room for them; but in the hills, where the only accommodation is poor and needed by the men, they are a very great comfort and convenience. From this camp as a centre we made several excursions, short in mileage, but long in difficulty. The first was up the mountain-side about 2000 feet, and our magistrate afforded us an opportunity of seeing a Chinese official mountaineering. He did it on a coolie's back—2000 feet up a mountain path frequently cut into steps to give a foothold. Subsequently we inveigled him into an ascent of 2500 feet on his own legs, but the effort nearly killed him, and he had to be carried down. Afterwards he plaintively remarked "that Chinese gentlemen are never taught to walk." On this trip a large number of apes about the size of collie dogs were seen. Norris and I also tried to reach a mine to the north, but failed owing to heavy snow-drifts on a dangerous road. From 7000 to 10,000 feet we saw

but little of the country, as dense clouds shrouded the hills. At this latter height we camped for the night, the weather being surprisingly mild. Next morning we made a further 4 miles, with much heavy snow on all slopes with a northerly aspect, and an exciting descent of about 40 feet along a notched log thrown diagonally across a cliff some hundreds of feet high. Our guide did not seem to mind it, but the rest of us did. Crossing a pass of 11,250 feet, we started to descend into a valley; but the southern side being very steep and covered with several feet of loose snow, our guide gave up as lost within a mile of our objective. Tigers and yaks were reported to inhabit the mountains, but we only saw the tracks of deer and a big dog-like track. As just previous to our noticing the latter, our military escort had insisted that we should go ahead with our revolvers to protect them from tigers, we did not think it advisable to ask their opinion as to its origin, as we wished to go on further. Descending the valley of the Chian kiang from Tung-ling-tse, we ascended two tributary streams on the right bank. The largest of these, the Pei-shewi-ho, is just a rift in the mountains, and no cultivation is possible—a marked contrast to the valley of the main stream. Returning on our tracks, we reached Cheng-tu on the 15th, and made the necessary arrangements for a six weeks' trip to the north, mostly by way of Captain Gill's route. As Captain Gill mapped with greater accuracy than I was able to, only the deviation from his route is shown.

On April 26 we left the main Pekin road, at Tse-te-chau, some 19 miles north-north-east of Cheng-tu, and then proceeded N. 28° W. until we reached the town of Shi-fung-hsien. Between this town and Mien-chau we crossed the boulder-strewn bed of a river, about half a mile wide, which must undoubtedly be that crossed by Gill 10 miles to the east-south-east. Shortly after crossing this stream the hills bordering the plain were noticed about 10 miles off, with a gap from which one branch of the stream evidently flows. As for the other streams which cross the route between Cheng-tu and Chi-shwei-ho, although a good idea can be formed as to where they leave the hills, it is impossible to give their eastward direction, as they are so completely split up and trained to serve the needs of man, that it is often uncertain whether it is a natural stream or a canal that crosses the road. Mien-chau is a large city enclosed by a strong wall and moat. What the population was we did not hear; but if Pen-hsien contains 60,000, I should say this city should contain about 100,000. Its industries are paper-making and tobacco, and as it is reached by boats, it is also of importance as a distributing centre.

After leaving Mien-chau, the edge of the plain lies about 4 miles west of the road until 4 miles past Chi-shwei-ho, where the road crosses a low pass in the foothills and runs down a small river to An-hsien. The whole plain from Cheng-tu to these foothills was a scene of inde-

scribable beauty, the fields being one mass of brilliant colour with huge poppies of every possible tint, broken only by the green of groves of bamboo, poplar, and willow surrounding the white-walled, black-roofed farm steadings. The amount of opium produced must be enormous. By the courtesy of the officials at An-hsien, we were put up in the Cantonese Guildhall, or club-house, just outside the city. This was a beautiful little place, with gardens, groves, and rockeries, and a couple of very clean and pleasant summer-houses. An-hsien is a station of the Church Missionary Society, five missionaries being there; while two ladies are stationed at Shih-chuen, further to the north-west. To the north of the town there is a very fine wing dam about half a mile long and 10 to 14 feet high, of solid concrete, built to keep the river from flooding the town. After a day's delay we proceeded to run the river up to reach Shih-chuen. Two miles from An-hsien we crossed it by a long three-span bridge of wrought-iron chains, with planks laid across them for a decking, forming a light and elegant structure. From Li-ko-ping we followed up the main stream for 12 miles, and, then returning, crossed over a pass (2930 feet) and descended to Chusan (2300 feet), on the right bank of the Shih-chuen river, and camped.

From Chusan to Shih-chuen-hsien is a good day's march, the road being very hilly and rough. Just before entering the town the river is crossed by a bamboo suspension bridge of 240 feet span, built of plaited bamboo cables, each as big as a man's thigh. Eight of these support a wicker floor, and two on either side form side chains. Though the bridge sways considerably, ponies are always being ridden across it, so it must have ample strength. The cables are strained by big capstans on either bank, and the whole bridge is, I am informed, renewed at intervals of about three years—no small tax on a town of 10,000 inhabitants at the outside. Excursions up the two branches of the river gave their courses for a few miles, but when we left them they were still of very considerable volume. They are crossed when required by the "single-rope" bridge, which is common in Tibet. The river is tumultuous and full of rapids, rendering it quite unfit for navigation until Tung-ko is reached.

After returning to Chusan we made east, rising to 4930 feet in 3 miles, before descending gradually to Tung-ko (2110 feet), a large village on the right bank of the Shih-chuen river, which reappears from the north. From here the road runs generally east-north-east through low hills, partially cultivated, till it reaches a large river, which I have been unable to identify with any on Captain Gill's route. Boats are to be seen on it. Five miles further brought us to Chiang-yu-hsien, where we rejoined Gill's route.

One of the most conspicuous traits of the Chinese of the plain is their aversion to cold drinks. Every mile or two, and on main roads every few hundred yards, tea-houses are to be found where the thirsty

wayfarer, on payment of about a quarter of a farthing, can obtain a basin with a few tea-leaves in it and as much boiling water as he cares to drink. Sometimes the tea is absent, but no matter—you drink the boiling water. This custom is universal: I do not think I ever saw one of them drink cold water, and they have even tried to dissuade me from drinking of a mountain torrent far above all habitation. Certainly upon the plain, where the land is heavily manured, and all the water has been used for irrigation somewhere or other, it would be simply suicidal to touch unboiled water, and no doubt the natives have learned the lesson from experience. As an example, I have even seen the village water-supply taken out of one end of a rice-field while the village sewage was being emptied into the other.

In conclusion, I can only say that the district described is one of the greatest interest to the traveller, not only for the fine scenery of the surrounding hills and the beauty of the plain, but—and chiefly, to my mind—as an example of what can be done with a systematic and complete system of irrigation, and the most intense cultivation probably in the world, to carry a teeming population scrupulously careful to return to the soil everything that can be given it, and the reward is six crops a year according to Chinese information. The prevalent crops we saw were: March 17, rape in flower and pod; April 25, poppy; May 31, tobacco; June 20, rice being planted out. I can quite believe the statement that another crop of rice and a sixth crop is raised. These appeared to be the main crops, but wheat, barley, buckwheat, saffron, beans, cabbage, egg-plant, and others of lesser importance were also to be seen. Unfortunately, as we did not see the same fields carrying these crops in succession, proof is lacking, but each trip was through one main crop. Most of the main crops are raised in seed-beds, and immediately the residue of the last crop is ploughed in, the seedlings are planted out. For example, the rice is about a foot high when planted out stalk by stalk into the paddy-fields. The labour, of course, is enormous, but the result is that 4,000,000 people live on a plain of perhaps 3000 square miles.

'THE TANGANYIKA PROBLEM.'*

The contents of this volume are zoological and geological, but the principal questions under consideration are of geographical importance. These questions are: the physical geography of Central Africa in past times, and the distribution, past and present, of the animals inhabiting

* 'The Tanganyika Problem: an Account of the Researches undertaken concerning the Existence of Marine Animals in Central Africa.' By J. E. S. Moore, F.R.G.S. Hurst & Blackett, Ltd.

the lakes and rivers of that region. The problem to be solved was the occurrence in Lake Tanganyika of certain shells and a jelly-fish belonging to types supposed to be exclusively marine.

For the solution of this problem and for inquiries into the geography, geology, and zoology of the lake region in Central Africa, two expeditions in succession under Mr. Moore's charge were dispatched to Lake Tanganyika and some other Central African lakes. Both of these expeditions have been fully described in the *Geographical Journal*, and it will suffice in the present case to notice briefly the scientific results as presented in the present volume.

Mr. Moore's task has been successfully achieved. Whether his conclusions be accepted or not, there can be no doubt of the thoroughness of his work. The fact that he has, as he states, added two hundred new species to the fauna of Central African lakes, shows how extensively he must have collected, and he has himself investigated the anatomy of the mollusca and of some other invertebrates. There are but few travellers, even at the present day, who have the anatomical and zoological knowledge which have been employed in the investigation of the Tanganyika fauna. Mr. Moore has also, with the assistance of Mr. Fergusson, been able to add considerably to our knowledge of the geology of the African lake region.

The results of the Tanganyikan exploration may be divided into two series: those which are mainly geological, and those which relate to the distribution of animal life. The two are closely connected, but as they are the subjects of different chapters in the present work, they may be noticed separately.

The principal great systems of rocks in the lake region of Central Africa are stated by Mr. Moore to be, in descending order—

1. African lake pleistocenes.
2. Drummond's beds: sandstones and shells of approximately Triassic age.
3. Old African sandstones: sandstones and shales, unfossiliferous, of great thickness and of unknown age.
4. Crystalline formations: schist, gneiss, granite, etc.

This succession, if the subrecent lake-beds be neglected, is in the main similar to that found in South Africa and in the peninsula of India, the Drummond's beds being apparently the equivalents of the Karoos and Gondwánas, whilst the old African sandstones may possibly represent the Table mountain sandstones of South Africa and the Vindhyans of India. The older series has hitherto proved unfossiliferous, and its origin is obscure. It is commonly supposed to be of marine origin, but in the absence of fossils proof is wanting that the ancient sandstones and shales were formed in seas or oceans like those of the present day.

The occurrence in the Drummond's beds of ganoid fishes and of bivalve mollusca related to those found in Lake Tanganyika, together

with the reported discovery of an echinoderm near Lake Nyasa, is regarded by Mr. Moore (p. 72) as evidence that the strata are of marine origin. The bivalve shells of Tanganyika are, however, of exclusively fresh-water types, as are the ganoid fishes also (there is no reason why some Triassic ganoids may not have lived in fresh water), and the echinoderm noticed by Dr. Gregory was of doubtful origin and of Oliocene age, so that it clearly could not have come from the Drummond's beds. The view that these rocks are of marine origin cannot be regarded, on the evidence brought forward, as even probable. It is more likely that, as in the case of their South African representatives, they are of fresh-water origin and very largely fluviatile.

The point would have been hardly worth mentioning but for the circumstance that Mr. Moore has prominently attacked what he terms (p. x.) "Murchison's erroneous hypothesis concerning African stability." If, however, the strata here termed Drummond's beds are of inland origin, Murchison's views are not very far wrong, and the theory that Central Africa is part of an ancient land area is greatly strengthened. It is true that Mr. Moore's criticism is chiefly put forward in opposition to the idea that no mountain ridges have been formed in Africa since Mesozoic times; but that changes may have taken place in parts of the area was fully admitted by Murchison (*Jour. Roy. Geogr. Soc.*, vol. xxii., 1852, p. 123).

The principal geological question to which attention was directed in connection with the Tanganyika problem was the origin of the lake area. This is thus explained. At a period subsequent to the formation of the Drummond's beds, but not clearly determinable, a great change in the physical geography of Central Africa commenced, and has continued to the present day, resulting in the elevation of a meridional axis extending from the Nile to the Zambezi. For this axis, which culminates in Ruwenzori, Mr. Moore proposes the name of the "Great Central Range." In this tract of elevated ground, the "Graben" of Suess and "Rift-valleys" of Gregory and other writers, for which is proposed the new name of "Eurycolpic folds," have been formed as a result of the general folding from lateral pressure. It is shown that these valleys are not simply meridional, but that they branch and intersect each other in places, and Mr. Moore is inclined to compare them to the equatorial canal-system of Mars rather than to the rifts on the Moon's surface.

It is doubtful whether the new term, "eurycolpic fold," is an improvement on "rift-valley" (trough valley would have been better), for these remarkable features are not, strictly speaking, folds, but longitudinal blocks let down by trough faults, and they are not always "eurycolpic" (broad bosomed), some being comparatively of no great breadth. Unfortunately, the difficulty of accounting for these valleys is not removed by renaming them.

In the bottom of these curious troughs volcanic cones are of somewhat frequent occurrence, and testify to the immense pressure accompanying the dislocations that have taken place. One of the volcanic areas, that of the Mfumbiro mountains, north of Lake Kivu, received especial attention, for it forms the water-parting between the Congo and Nile drainage areas. It is shown that, previously to the eruptions to which the Mfumbiro cones are due, the water of Lake Kivu, south of them, drained northward to the Albert Edward Nyanza and Albert Nyanza, which occupy the northern extension of the Tanganyikan trough, and that the present drainage of Kivu to the southward into Tanganyika by the Russisi river is due to the dam formed by the volcanic accumulations.

In several places Mr. Moore calls attention to evidence showing how recent some of the dislocations must be to which the valley troughs are due. It is clear that if the cliffs bordering the valleys were not of very recent geological date, they would have been destroyed by the action of denudation.

Turning now to the biological questions involved in the Tanganyika problem, we enter upon debatable ground. The preliminary question as to whether the marine types were confined to Lake Tanganyika or whether representatives were to be found in other inland waters has been decided. An examination of the fauna found in the numerous lakes of Central Africa, from Rudolf and Albert Nyanza to Bangweolo, Nyasa, and Shirwa, has shown that the marine forms of mollusca, or "halolimnic types," as they are termed by Mr. Moore, are confined to Tanganyika. The absence of these shells from Kivu, Albert Edward, and Albert, to the north of Tanganyika, is opposed to a theory once suggested—that the marine forms found their way into Tanganyika from the Red sea.

The explanation of the Tanganyika problem offered by Mr. Moore is the following: The fauna of the lake is twofold, an ordinary fresh-water fauna consisting of genera of fish, mollusca, etc., common to other African lakes, and in most cases of wide distribution, and the "halolimnic" group. The latter are regarded as the original inhabitants, and the ordinary fresh-water forms are of more recent introduction. The "halolimnic" mollusca belong to fourteen genera, all univalves, and of these no less than eight so closely resemble forms found fossil in the Jurassic rocks of Western Europe, that there is good reason to regard them as descendants of the same or similar species. It must be remembered that evidence of this kind is accumulative, the resemblance of one or two shells might be due to accidental similarity, but it is very questionable whether the numerous instances here described and illustrated by excellent figures of the modern and ancient forms side by side can be attributed to fortuitous resemblance. The halolimnic fauna is therefore regarded as derived from marine organisms of Jurassic age, and as

the structure of the animals is shown to be of a generalized or primitive type, it is a reasonable conclusion that these genera have retained the external and internal structure of forms belonging to Middle Mesozoic times. In retaining a structure less specialized than that of their nearest marine relations, the halolimnic types of Tanganyika agree with most forms of fresh-water life, but they are distinguished by their relation to a fossil fauna of a definite geological age.

How those descendants of old Jurassic molluscs found their way into Tanganyika is not quite so clear, but it is inferred that they may have inhabited the area of the lake since this tract formed part of a Jurassic sea, which is supposed to have extended over the Congo basin.

So far as this the views expressed in the present work may be accepted as justified by the evidence, though some of the data on which the former existence of a marine area in the Congo basin is inferred are not convincing. For instance, some weight is attached to the presence in the present Congo estuary of a genus *Tympanotomus*, allied to one of the Tanganyikan genera. But this same genus abounds on the shores of the Indian ocean, and might consequently be regarded as showing that the Tanganyikan halolimnic fauna is of Eastern origin.

The weakest point in the connection between the Tanganyikan halolimnic fauna and the Jurassic marine fauna is that it is confined to univalve shells belonging to a single section. In Mr. Moore's opinion, besides the halolimnic mollusca, the prawns, crabs, sponges, jelly-fishes, and several of the fishes, the ganoid *Polypterus*, the dipnoan *Protopterus*, some of the Characinidæ, and most of the Cichlidæ (p. 340), should be included in the halolimnic group. So far as some of the invertebrata are concerned, he may be right, but none of them have the same specially Jurassic affinities as the mollusca, whilst not only are all the fishes widely spread types, but the Cichlidæ in especial are perch-like forms, nothing resembling which is known from Jurassic rocks, or in any beds older than Upper Cretaceous. It is urged (p. 340) that Tanganyika is the original centre from which the Cichlidæ were distributed, firstly, because of the number of species occurring in the lake; secondly, because of their primitive character. The second argument may be of some importance; the first is not, as a single instance will show. The majority of living antelopes are African, but the original source of the antelopes was in all probability in Europe and Asia.

There are some other opinions expressed in 'The Tanganyika Problem' to which it is desirable to call attention, because they are different from those held by biologists generally. They are found in chapter ii. Mr. Moore discusses the distribution and origin of fresh-water faunas, and concludes (p. 29) that they are "chiefly composed of the remains of a once widely distributed and ancient sea-fauna, the ancestors of the surviving components of which were forced out of the ocean into the fresh waters of the globe owing to a change in the

character of the sea itself. This change appears to have become sufficiently strongly marked to have produced an appreciable differentiation at a period roughly corresponding to the commencement of the secondary rocks. In this matter it would appear that assemblages of similar organisms have of necessity taken to fresh water all over the world about the same time."

This startling hypothesis is a return to the doctrine of the "sporadic origin" of species and genera current in pre-Darwinian times. The whole subject of the origin of fresh-water faunas was discussed by Darwin in chapter xii. of the 'Origin of Species,' and his conclusions are opposed to those expressed in 'The Tanganyika Problem.'

There is one objection to the hypothesis of the ordinary fresh-water fauna having been derived from the marine life of any single geological epoch, which may be mentioned, because it has a particular reference to the Tanganyikan fauna. Mr. Moore has shown that near allies of several Tanganyikan halolimnic shells are found in Jurassic strata, and has inferred that the Jurassic forms were the ancestors of the recent genera. But where is the ancient marine fauna from which *Unio* and *Corbicula, Vivipara* and *Melania, Lymnea* and *Planorbis*, are probably derived? The first step towards establishing a common origin for these genera is to show that a fauna once existed from which all might have descended.

The earliest strata in which an assemblage of fresh-water mollusca is found at all nearly approaching that of the present day is in the Purbeck and Wealden, Upper Jurassic and Lower Cretaceous. Had these forms established themselves in fresh waters about "the commencement of the formation of the secondary rocks," why are none of them found in the Trias, in which there is no lack of strata of fresh-water origin? It may be added that, although many fish are known from Triassic rocks, nothing resembling the commonest forms of fresh-water fish-life, such as carps, siluroids, and percoids, occurs amongst them.

The opinion is expressed (p. 30) that fresh-water mollusca have but little tendency to migrate, and that fresh-water fishes and the more active invertebrata have greater migratory powers than mollusca. This is opposed to the views generally held. It is well known how quickly an artificial pond, with which no stream is connected, becomes stocked with fresh-water shells, and Darwin and others have shown how the young are transported by birds, whilst it is a well-known fact that the larvæ of pond-mussels (*Unio*) attach themselves to fishes. The specific differences between the different African lakes, strongly and repeatedly insisted upon by Mr. Moore as evidence of a separate origin of the mollusca inhabiting those sheets of water, will not weigh much with those who know on what trivial differences "species" of fresh-water mollusca are founded.

There is one more argument of Mr. Moore's which must be challenged.

He says (pp. 19, 20), "The distribution of Characinid fishes in the American and African fresh waters is quite inexplicable on any supposition of their having originated as a relic fauna in some one arm of the sea, . . . for there is no evidence that there has been any connection between the remote state (*sic*) land masses which these bodies now inhabit. . . . It is the same with the Cichlidæ and many other forms of fish." The view advocated is that these African and American freshwater fishes must have originated, on both sides of the Atlantic, from marine forms simultaneously, but independently. It is sufficient to say that no such origin could account for the distribution of Amphisbænidæ, a family of land lizards, with a similar distribution to that of the Cichlidæ and Characinidæ. Mr. Moore cannot be acquainted with all that has been written, both by biologists and by geologists, as to the former land connection between Africa and South America, a connection which appears to have existed during Jurassic and Cretaceous times, and which probably continued in the early Tertiaries. The geological data are treated by Suess in the 'Antlitz der Erde;' the biological, palæontological, and recent facts are to be found scattered through a number of works, the earliest being by the late Prof. Neumayr. The principal data known in 1890 are contained in the presidential address to the Geological Society for that year, but additional evidence has since been brought forward by Gregory, Beddard, and others, one of the most recent contributions to the subject being that of Dr. Max Schoeller, noticed in this *Journal* for January, p. 67. But the facts are so widely known, that it is remarkable to find them, together with those contained in Darwin's 'Origin of Species,' completely ignored by a writer who is propounding novel views on the distribution of animals.

If, however, no favourable opinion can be expressed on some of the biological theories announced in 'The Tanganyika Problem,' the descriptions and figures of the animals found are of great merit. The account of the fishes is by Mr. Boulenger, and the accompanying figures, both coloured and uncoloured, are admirably executed. The descriptions of the mollusca and of the other invertebrata are by Mr. Moore, and form a valuable addition to knowledge, and the accompanying cuts are good. The landscapes in the earlier part of the book are less successful, and it is to be regretted that misprints are rather numerous throughout.

W. T. B.

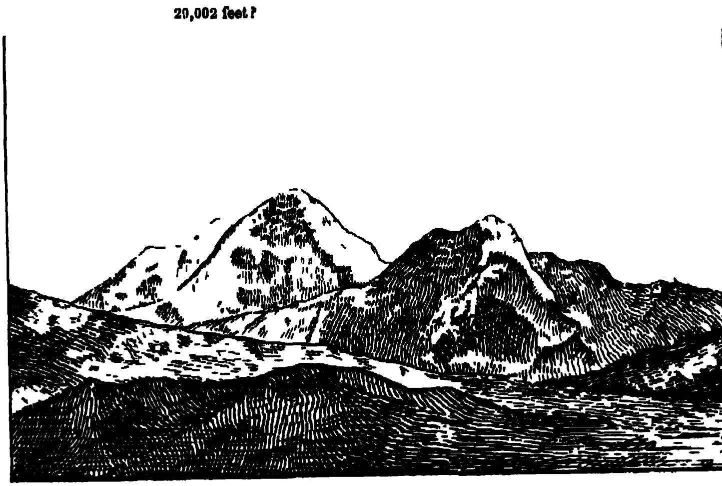
THE HIGHEST MOUNTAIN IN THE WORLD.

By DOUGLAS W. FRESHFIELD.

Some years ago (in 1886) I argued,* with a pertinacity which I am afraid may have seemed presumptuous to some of my readers, against

* *Proceedings of the Royal Geographical Society*, vol. viii. New Series; and *Alpine Journal*, vol. xii

the conviction of the late General Walker, formerly the head of the Indian Survey, that Hermann Schlagintweit, together with Mr. Brian Hodgson, a witness of great weight, and other more recent Residents in Nepal, were mistaken in believing that the snowy peaks visible to the east from the neighbourhood of Katmandu, and called "Gaurisankar" by the inhabitants, in all probability include the triangulated peak, 29,002 feet, commonly known in England as "Mount Everest."



PEAKS SEEN TO THE EAST FROM HILLS NORTH OF KATMANDU.

(After Herr Boeck's photograph.)

Major (now Colonel) Waddell, an authority on these matters, expresses what I presume has been the popular verdict on the discussion in the following terms: *—

"On the Continent one of the vague Indian mythological names, obtained by Schlagintweit from the Hindooized Nepalese of Khatmandu, for a mountain which he supposed to be identical with the Everest of the Survey, is usually assigned to it—namely, 'Gauri-sankar,' one of the titles of the conjugal Indian god Shiva, the Destroyer, and his wife. But it is not generally known that the identity of these two mountains has been conclusively disproved by General Walker, the late Surveyor-General of India, and by Colonel Tanner, his deputy. Owing to the curvature of the Earth, and the interposition of other ranges, it is physically impossible to see Everest either from Khatmandu, or the Kaulia or Kakani peaks, whence H. Schlagintweit believed he saw it,

* 'Among the Himalayas.' By L. H. Waddell. 1899 I have not altered the spelling of the local names adopted by the author.

and got his local name, 'Gauri-sankar.' As for Kanchenjunga, which Schlagintweit says was also visible from that position, it is shown to be 'fully 100 miles *beyond the most remote* point visible from that locality.' And Colonel Tanner has directly proved that the Gaurisankar of Schlagintweit is certainly not the Everest of the Survey, but a much smaller and totally different mountain. He writes, 'I have now before me the panoramic profiles and angular measurements of Major Wilson, for some time Resident in Nepal, who observed from Sheopuri, a point on the Kaulia ridge. Schlagintweit's Gaurisankar, the "Everest" of successive political Residents in Nepal, was pointed out to Major Wilson, and from his angular measurements I am able to identify that peak as No. XX., 23,447 feet, more than a mile lower than Everest, and in point of distance very far short of it.'"

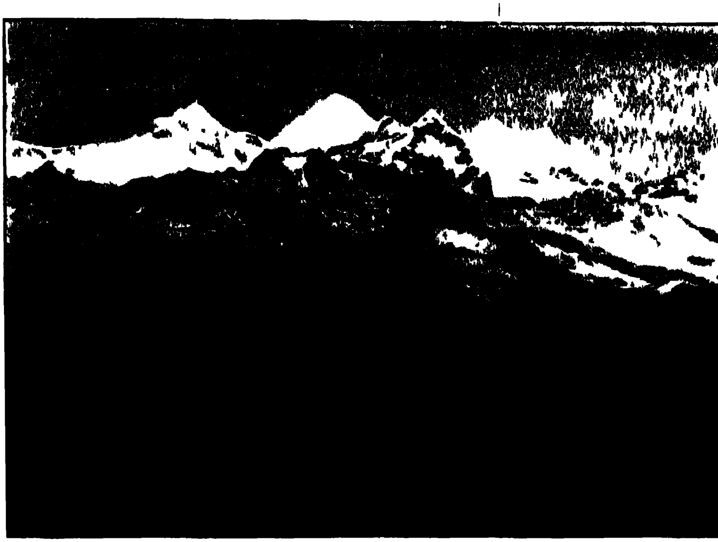
So far Colonel Waddell. His assertions are convincing at first sight; but they do not bear examination When we refer to the official map, of which he furnishes a reproduction, we notice that there is nothing in that document to show that it is impossible, either from the curvature of the Earth or the interposition of other ranges, separately or combined, for the peak of 29,002 feet to be seen at a distance of 105 to 110 miles from a height of 7000 to 10,000 feet, some 7 miles north of Katmandu. From Katmandu itself the great peak would apparently be covered by the peak XVIII., 21,957 feet. But what can be seen from the city itself never formed any part of my argument.

In 1886 I concluded my share in the discussion by stating that it must be left for some competent observer at Katmandu to decide whether the 29,002-feet peak is visible from the hills in the vicinity.

At the end of last year two fresh pieces of evidence turned up. Lieut.-Colonel Pears, the Resident at Katmandu, confirmed to me the report of his predecessors that the snows seen to the east from near Katmandu are locally called "Gaurisankar," and Mrs. Pears exhibited at the Alpine Club a sketch of this range. The objection will, of course, be taken that this new evidence by itself is only a confirmation of the statement of earlier travellers that the eastern snows seen from this quarter are called Gaurisankar, and no proof that the 29,002-feet summit is one of the peaks visible. But we have also, in a German work * just published, a photograph of the view of the eastern snows from the hill (Kaulia and Kakani are points on the same ridge) visited by Schlagintweit, with what is obviously an enlargement of part of it, showing the principal group.

Now, in these photographs, just over the northern flank of a peak we can hardly be wrong in recognizing as XVIII., appears a snowy mountain, the outline of which corresponds very closely, taking into account the relative positions from which the photographs were

* 'Durch Indien im verschlossenen Land Nepal' By Dr Boeck 1893



Telephotograph

THE NEPAL PEAKS FROM HOOKER'S CHUNJERMA

Telephotograph

THE NEPAL PEAKS FROM SANDAKPHU.

obtained, with the outline of the 29,002-feet peak in Signor Sella's photograph, as seen from the Chunjerma pass in eastern Nepal. And this mountain is, with regard to peak XVIII., in the exact position where "Mount Everest" should be. It may be, as the surveyors insisted, hidden from the city by peak XVIII., but the situation of Kakani, a few miles further north, suffices to open it.

This summit was, we understand from Dr. Boeck, pointed out to him as Gaurisankar, and he apparently, quite unconscious both of the previous visit of his fellow-countryman to the spot, and that he is dealing with a controversial matter, congratulates himself on his accomplishment of a pilgrimage to "Gaurisankar-Everest, the highest mountain of the Earth."

It seems, therefore, to me that Dr. Boeck has furnished some further ground for believing that Mr. Hodgson was right after all, and that the summit known in this country as "Mount Everest" does form part of the group visible and known as "Gaurisankar" to the natives of central Nepal. I should add that a summit apparently corresponding in position with the peak XX. of the Survey is also recognizable in Dr. Boeck's photograph.

I trust I have made it clear that the point I have been arguing throughout is, whether the 29,002-feet peak is among the snows visible from Kakani, and known as Gaurisankar, and not, whether Schlagintweit, or Major Wilson, or other observers, have identified rightly the particular summit. Most visitors to Sikhim, including Schlagintweit and, at one time, General Walker himself, mistook Makalu for the highest peak. This does not affect the fact that "Mount Everest" is visible from Sandakphu. Nor could the failure of Europeans at Katmandu to recognize which was the culminating point of the group the Nepalese call Gaurisankar prove that the 29,002-feet peak is out of sight, or is not called Gaurisankar. An instance nearer home may help to make the case more clear. On the Italian lakes the Saasgrat has been frequently mistaken for Monte Rosa. No one would argue on this account that Monte Rosa is invisible, or has not the best right to its name. The reason for which the surveyors argued so strenuously forty-five years ago that the 29,002-feet peak cannot be the Gaurisankar of Nepal was, of course, that their chief's proceeding in giving the mountain an English name was excused, or justified, at the time by the assertion that it had no local or native name. We have now got two native names, the Indian name Gaurisankar and the Tibetan name Chomokankar, long ago brought forward by Chandra Das, and, though never, so far as I know, seriously disputed, generally ignored, until Colonel Waddell brought it into prominence. Personally I should like to see Gaurisankar win the day.

The illustration in the text is taken from Dr. Boeck's photograph. The two photographic plates show the aspect of Mapalu and the

29,002-feet peak from the south-east and somewhat south of east, at distances of 90 and 70 miles respectively.

Dr. Boeck declares quite positively that from Kakani he recognized Kangchenjunga, Kabru, and Jannu, and, as in a previous year he had made the trip from Darjiling to Pamionchi and Akluthang, he ought to have had no difficulty in recognizing such characteristic forms. Dogmatic assertions about the visibility of Kangchenjunga from certain points in central Nepal can, however, carry no weight until confirmed by substantial evidence. All depends on the exact height of the standpoint and the intervening ranges. As far as the curvature of the Earth is concerned there is no difficulty whatever. I have recognized with the naked eye, and examined with glasses, from a summit (Punta di San Matteo) of the Orteler group Monte Viso, 210 miles distant, and some of the triangulations of the Indian Survey depend on rays of even greater length. Kangchenjunga is less than 200 miles from Katmundu, and is 16,000 feet higher than Monte Viso. But, as far as I can judge from maps, the southern outliers of the Gaurisankar group, over 20,000 feet in height, would effectually mask the Sikhim mountains from the west. I trust that Colonel Pears, on his return to India, may be able, with the help of the Surveyor-General, to obtain telephotographic views of the visible ranges, with the bearings of the principal peaks seen from central Nepal, and thus settle definitely the matters still in controversy.*

THE CIRCULATION OF THE ATMOSPHERE IN THE TROPICAL AND EQUATORIAL REGIONS.

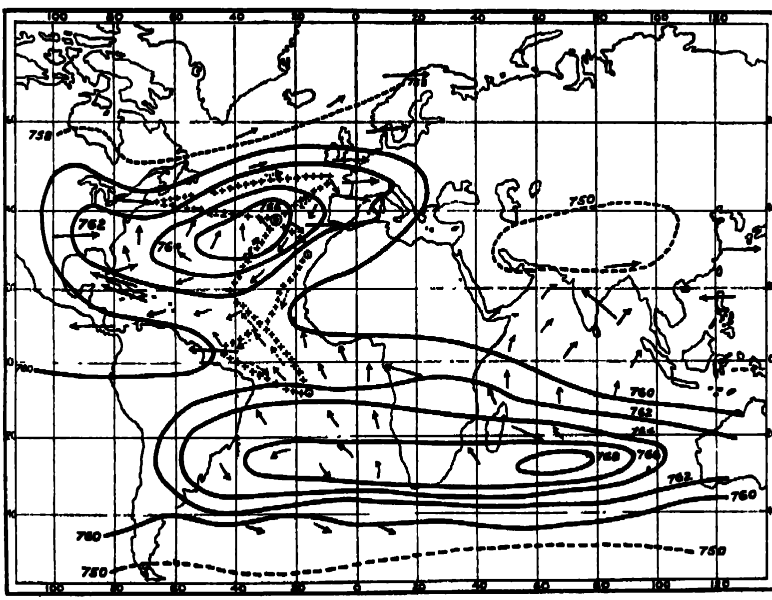
Mr. A. Lawrence Rotch communicates to the *Monthly Weather Review* for April last, the replies of Prof. Hildebrandsson to inquiries addressed to him as to the state of knowledge of the circulation of the atmosphere within the tropics, and the possibility of extending that knowledge by means of "soundings" with kites or balloons. Prof. Hildebrandsson's statement is as follows:—

The Upper Antitrade and its Investigations.

Theories of Atmospheric Circulation.—It has been believed from the time of Halley, and more fully developed theories have been put forward by Dove, Maury, and Ferrel, that the ascending currents above the thermal equator proceed immediately as south-west and north-west antitrades over the north-east and south-east trade winds. A part of the antitrade, perhaps, sinks down over the high barometric pressures in the North and South Atlantic oceans and returns with the trade winds, but the greater part of the antitrade first descends to the surface of the ocean north

* The report of the surveyor W. H. (published separately with a map in 1887) throws no light on the point under discussion, although he crossed a pass, the Pangu La, only 24 miles to the north-west of the 29,002-feet peak.

and south of the trade winds, and continues to the poles as the prevailing south-west or north-west winds of the north or south temperate zones. The facts upon which this theory is based are very meagre. It is only on the peak of Teneriffe (12,180 feet) that the antitrade can be observed the whole year. Its mean lower limit is at the height of 9000 feet, and this height is greater in summer than in winter. In October it sinks to 6000 feet. Leopold von Buch (as cited by Dove, 'Das Gesetz der Sturme,' p. 27) wrote in 1825, as follows: "Should we not believe that the west wind sought for on the summer voyages from Teneriffe to England in the latitude of the Azores and ordinarily found there . . . is, as well as the west wind on the summit of the peak, the upper equatorial current that has here come down to the level of the sea? It would then follow that the equatorial current of the upper regions, at least over the Atlantic ocean, does not reach the pole."



ISOBARS AND WINDS FOR JULY.

So far as I know, this is the only empirical fact upon which the theory is founded; but, on the other hand, it should be said that it is not proved that the surface wind at the Azores is the prolongation of the antitrade. When the centre of the barometric maximum shifts to the south, the south-west wind also moves to lower latitudes, and as the antitrade sinks near the centre at the same time, it probably must be at a lower level on the peak when the centre is approaching. But, as already stated, it is not certain that the antitrade reaches the surface of the ocean north of this centre of high pressure.

Ascertained Facts.—Our knowledge is very limited. We know that the antitrade exists over the trades, at least in the North Atlantic and at the Sandwich islands, but no one has found this upper current in Central America or in Ecuador, while the smoke of the highest volcanoes around Quito constantly indicate a strong wind from the east. On the accompanying map the isobars and surface

winds for July are copied from Hann's 'Atlas der Meteorologie,' while the long arrows indicate the directions of movement of the cirrus clouds in July. We see that there is a broad upper stream flowing from the east both above and on each side of the thermal equator. At Manila the direction is east-north-east, in India south-east, Congo east-south-east, Guiana and Costa Rica due east, Jamaica and Havana east-south-east, though in winter it is west-south-west at Havana. In about latitude 20° the direction is west-south-west at Key West and west-north-west at Mauritius, while over the whole temperate zone of the Northern Hemisphere, from the United States in the west to Assam and Shanghai in the east, westerly winds prevail. At Melbourne the direction is also west 16° N.

The observations discussed in the forthcoming 'Rapport sur les Observations Internationales des Nuages au Comité Météorologique International,' which will probably be issued this year, indicate that there exist in the upper regions—

(1) A strong easterly wind above the equatorial belt.

(2) Strong westerly winds over the two temperate zones, forming two immense polar cyclones, in which our ordinary cyclones are formed as satellites.

(3) At about 20° north and south latitudes the easterly wind rapidly shifts to the south-west and west. Above the peak of Teneriffe the antitrade blows from almost due west in winter; there are no observations in summer.

The late Mr. Abercromby observed with great care the upper currents in the doldrums of both the Atlantic and Indian oceans, and came to the conclusion that at high levels the two trade winds rather tend to coalesce into a single wind from the east, and that the poleward motion of air near the equator is very small. These results were got by watching very carefully the vertical succession of upper currents. In the Northern Hemisphere, if one stands with his face to the wind, the upper winds will be found coming more and more from the left hand the higher they are. In the Southern Hemisphere the rule is reversed, for then the upper currents flow more and more toward the left. Now, in his investigations, Abercromby found that with the surface wind blowing from south-east or south-west there was a more easterly wind at higher levels, or, in other words, that the vertical succession of winds proper to the Southern Hemisphere prevailed also for some distance north of the equator. In the southern Indian ocean from 10° to 12° S., during its season of north-west monsoon, he found the upper clouds coming from north-north-east or east, or, in other words, the rule of succession for the Northern Hemisphere extends a little over the equator into the Southern Hemisphere. Hence it is proved that the trades and monsoons do not meet, rise, and flow back poleward, but that the two winds coalesce to form one general easterly wind or one general current toward the west over the doldrums, which was observed directly after the eruption of Krakatoa in August, 1884. The dust went around the world at the equator in a few days, but did not reach middle latitudes until two or three months later. Our knowledge of the vertical variation of temperature and humidity is almost nothing, and we do not know whether there is a sudden change in these elements between the trade and the antitrade, etc.

Method of Exploration proposed.—The first experiment could best be performed in July and August, for at that season the thermal equator is at its most northerly latitude, and, of course, the doldrums and the prolonged south-east trade winds are broadest and best developed, since they extend over 10° of latitude, namely, from 0° to 10° north. Besides, we have then a fixed point in the Azores, exactly in the centre of the barometric maximum in the North Atlantic, and a party landed there during the expedition could do much interesting work in studying the central region of a tropical anticyclone. The expedition should leave Boston, Mass., at the end of June, and follow the track indicated by crosses and broken

arrows on the map. In skirting the isobar of 762 millimetres you should observe carefully the direction of the different clouds, and I trust you will find, as usual, that the upper winds come more and more from the left hand the higher they are, and will not find any trace of a descending "equatorial current." By means of vertical soundings with kites you will probably obtain the same result as at Blue Hill under the same weather type, although I confess that this part of the experiment would probably be more conclusive in winter, when the gradient between the Azores and Iceland is steeper. From the English Channel go directly to the Azores, cutting at right angles the isobars where they are widest apart, and, if possible, land a party at San Miguel to observe the clouds and make kite soundings in the very centre of the barometric maximum. Then go by way of Madeira to Teneriffe, namely, over that part of the ocean where the antitrade is always found at a height of about 9000 feet, and try to find its inclination, if any, with the underlying sea surface, the vertical variations of temperature and humidity in the two currents, etc. Then proceeding south past the Cape Verde islands to the doldrums, avoid the irregular conditions in the Gulf of Guinea, and go west between 10° and 0° N. to the South American coast at about right angles to the south-east and south-west monsoons. You will then have a totally unknown field to explore, but I think that you will find the surface winds becoming more and more easterly with increase of height, without any sort of antitrade, as at Teneriffe. In this course with the thermal equator the vertical soundings will surely prove of great interest. But it will be of the greatest interest if, in steaming against the south-east trade to the latitude of Ascension, you can find any evidence of the antitrade. It is curious that at Mauritius the upper winds are from west-north-west, against the south-east trade; in summer when there are no doldrums in the Indian ocean, the south-east trades at Mauritius and the south-west monsoon of India form an uninterrupted surface wind. Does there then exist a different wind above the south-east trade of the South Atlantic? If the kites do not reach up far enough, and if, as I fear, there are no cirrus to observe, try to send up from Ascension island a balloon without instruments—a true *ballon-perdu*—to the greatest possible height and watch its drift. In July the south-east trade is strongest, steady, and normal. From Ascension return over a more steady easterly track through the calms south-west of Guinea and the doldrums, then over a more westerly track to the Azores, and thence home, as indicated on the map. Try to find the upper trade wind in this westerly part of the northern barometric maximum. Thus, in a few weeks, you will be able to solve some of the most important problems in meteorology.

THE GEOGRAPHICAL ASSOCIATION ANNUAL MEETING.

The Annual Meeting of the Geographical Association was held on Friday, January 9, 1903. The President, Mr. Douglas W. Freshfield, occupied the Chair.

In his presidential address Mr. Freshfield said that, since the Meeting had in prospect more interesting matter, he would confine himself to making a few remarks connected with or suggested by the Report. His first impulse in facing such an assemblage of experts was to apologize for the position he occupied as their Chairman. Fortunately for the Association, however, its success depended not so much on the merits of its President as on the energy of its other officers and members. He regretted the unfortunate accident—a frost-bite on Monte Rosa—which had deprived the Meeting of the presence of their Treasurer, Mr. Masterman, who had, however, continued to take an active part in their affairs.

The questions he proposed to deal with were these: What progress is the Association making? In what directions should it concentrate its efforts at the present juncture?

The Geographical Association began its corporate existence as a body militant, a body struggling against a national and professional apathy, of which they recognized the dangers. Of those dangers the nation had since had some forcible examples. It would be premature to say that it had been awakened, but its slumbers had been at least sensibly disturbed. In the matters they had at heart there was visible progress in many directions. The School of Geography at Oxford, founded through the exertions of the Royal Geographical Society, was flourishing. Mr. Bryce, a most competent witness, had recently told him that he had found the teachers full of enthusiasm and the learners growing in number. "What a contrast," he wrote, "to our day!" The Vacation Course, held under the direction of Messrs. Mackinder, Beazley, Dickson, and Herbertson, seemed to have been most successful, and to have been much appreciated by the teachers who were able to attend. The University of London had quite lately recognized the aims of the Association by adding his name to the Geographical Board of Studies, and, at the other end of the educational ladder, the School Board of London set a geographical paper to which ten thousand children sent in replies, and for which two hundred and fifty pupils were commended. It was still among the head-masters of the great upper and middle-class public schools that they met with most apathy. In another quarter, indirectly educational, they had made advances by establishing more intimate relations with the heads of the Ordnance Survey, which, under its present Director, Colonel Johnston, had carried out many of the suggestions made ten years ago on behalf of the Royal Geographical Society by himself. More had still to be done, particularly in popularizing the maps by a better system of distribution and sale; and they might hope that, under a new Postmaster-General, the Post Office would no longer stand in the way, as it had in the past, in stultifying its offer to sell the Ordnance maps by insisting on superfluous and vexatious formalities.

The greatest advance made by the Association in the past twelve months had, however, undoubtedly been the issue of their new magazine, *The Geographical Teacher*. In a society the members of which, from the nature of things, could not hope often to meet, a magazine furnished an almost indispensable bond of communication and union. Each number had proved a real success in every respect. He trusted the magazine would prove an increasing success. He ventured to express a purely personal hope that writers would eschew as far as might be possible all needless technicalities. There was a sort of scientific language that sounded very like jargon to unscientific ears. He would not, for instance, for worlds speak disrespectfully of the equator, but he might confess to a wish now and then to put down a "consequential brook." They must remember that the business of the Association was to rub into the British public the practical importance of geographical intelligence, whether in war or in politics, in commerce or in colonization. As to war, they had the utterance of that distinguished officer and surveyor, Sir Thomas Holdich, who, as President of the Geographical Section at the Belfast meeting of the British Association, made the following remarkable avowal: "Personal experience convinced him that the apathy shown by many of our foremost generals and leaders on the subject of maps arose chiefly from a well-founded doubt of their own ability to use them." This sentence he quoted from the *Times* of the date. He wished they could feel sure that the lessons of the late war had been taken to heart by those who were responsible for Army examinations. As to politics, what did they think of gentlemen who called Heligoland "the Pearl

of the Baltic," or Batum "the key of the Persian Gulf," setting up to instruct the public in the newspapers? His last words should take the form of a few practical suggestions. They would remember that they were the words of an amateur, of one who was an outsider among experts; and they would take them only for what they might seem worth.

He believed teachers should, for the present at any rate, aim at keeping the practical side of geography in view, should insist on its importance in regard to human life and national prosperity; that they should urge its claim, not so much as a separate or a special subject, but as an aspect of almost every subject already taught, and as a link between them. He would not exaggerate the place of *Heimatkunde*. Remembering that the imaginations of young people are most easily stimulated by what directly concerns humanity, he would not, with beginners at any rate, incline too heavily or exclusively on the side of geography which touches geology, on the study of surface features—geomorphology was, he understood, the new phrase. And at the present moment he would make it one of our first objects to give British citizens a clear understanding of the territories oversea that constitute the British Empire. Ignorance, a dense ignorance that regards emigration as a plunge into the unknown, only less formidable than death, was one of the greatest hindrances to the better distribution of our race throughout the Empire. Such distribution is the only alternative either to overcrowding and misery at home or to such a limitation in the increase of population as is one of the normal signs of decadence in a country. The task ought not to prove too difficult. Photography and the lantern could come in a marvellous manner to the assistance of the teacher. Slides, such as those prepared by Mr. Andrews and others, might be more extensively used. Every one knew how by such means the clergy had drilled into children's minds the features of Palestine and of life in the East. We might take a lesson from these pious enthusiasts, and do the same for Canada, Australia, and the Cape. He must now make place for one who could speak with authority as regards Australia, Sir J. Cockburn, formerly Prime Minister of South Australia, who had been kind enough to respond to their invitation, and would address the meeting.

The Hon. Sir John A. Cockburn, K.C.M.G., M.D., then delivered an address on Australia.

Mr. A. W. Andrews then exhibited a number of maps, views, and diagrams illustrative of the Ordnance Survey maps. He said that the use of maps showing land elevation must be an integral part of any intelligent geographical teaching. For a satisfactory delineation of relief and steepness of slope, maps such as the series of part of the Chilterns prepared for the "war game," and showing contour lines at 10 feet, were necessary. The admirable hill-shaded maps combined with contour-lines issued by the Ordnance Survey should enable teachers to deal with the relief of their own neighbourhood. By slides of maps and pictures of the coast of Cornwall in the Land's End peninsula, he then showed the way to treat a typical area.

Sir Joshua Fitch proposed, and Prof. Westlake of Cambridge seconded, a vote of thanks to Sir John Cockburn and to Mr. Andrews.

The Annual Report was then approved, and office-bearers elected for 1903.

A series of typical sheets of the Ordnance Survey maps was exhibited at the meeting, and afterwards in the map room at 1, Savile Row, where a number of teachers and others inspected it.

REVIEWS.

EUROPE.

Iceland.

'Across Iceland.' By W. Bisiker. With Illustrations and Maps, and an Appendix by A. W. Hill on the Plants collected. London: Edward Arnold. 1902.

A number of narratives of travel in Iceland by Englishmen and Americans have appeared in recent years, but, unfortunately, few contain anything of geographical or scientific importance, and still fewer any new information. A book, therefore, describing a really new geographical examination of some part which was little known before is very welcome, and such a work is that of Mr. W. Bisiker. The author made it his especial task to examine and survey the Kjalvegur country between Hofsjökull and Langjökull, in Central Iceland. Although this route is annually used by travellers, and has been described by various scientific men,* Mr. Bisiker is the first who has surveyed this region in detail, and he has published in his book an excellent map of the central part of Kjalvegur, which gives his work permanent value. It is to be hoped that the author will continue his explorations of little-known districts in Iceland or elsewhere, which he has so well commenced. Work is plentiful everywhere, but the trained labourers are few. The party stayed some time at the remarkable group of warm springs on Hveravellir, explored the neighbourhood, and ascended the volcano Strytur and other adjacent summits. Hveravellir and its surroundings were first examined by E. Olafsson in 1752, and were fully described by Ebenezer Henderson in 1815,† but since then the warm springs are much changed. From Hveravellir Mr. Bisiker made an excursion to Kerlingarfjöll, a wild mountain group of liparite, where great solfataras and fumaroles burst forth in deep fissures amidst ice and snow; the sulphurous fumes have converted the rocks into soil of various colours, and the whole scene has a grand and fantastic character unmatched in any other part of Iceland.‡ From here Mr. Bisiker proceeded to the pretty Lake Hvítárvatn, which is filled with fragments of ice from two glaciers which extend into the water. All these places are well and clearly described by the author in a very agreeable style. After his researches in Kjalvegur were ended, Mr. Bisiker travelled to Reykjavik, to the lava caves of Surtshellir, to Stykkishólmur at Breidifjördur, and then on a coasting steamer round Cape Nord to the north and east coast. He therefore saw only a small portion of inhabited Iceland, and as his route, except in Kjalvegur, touched districts which have been repeatedly described by travellers, he had no opportunities for fresh inquiries.

The book contains many striking photographs which give a good picture of Icelandic scenery and manner of travelling, and several are also of geographical and geological interest. In many English books of travel Icelandic names are so

* I have myself, among others, described the geography and geology of this region in the *Geografisk Tidskrift*, vol. x. (Copenhagen, 1889), pp. 10–29; and *Ymer* (Stockholm, 1889), pp. 49–59, where also is to be found a special map of the hot springs at Hveravellir.

† 'Iceland; or, the Journal of a Residence in that Island during the Years 1814 and 1815.' By E. Henderson. 2 vols. Edinburgh. 1818. This work is still in every respect the best, most complete, and trustworthy narrative of travel in Iceland that exists in English.

‡ Kerlingarfjöll was first explored by me in 1888, and I described the mountain in *Das Ausland* (Stuttgart, 1889), No. 9, pp. 161–164.

incorrectly spelled that a whole course of study is necessary in order to recognize them, but Mr. Bisiker writes the names correctly as a rule, though I can quote some exceptions which should be corrected in a new edition. The following are the most important errors: "Falakvisl" for Fúlakvísl, "Hoff Jökull" for Hofs Jökull, "Asquidsá" for Asgardsá, "Skrutharfell" for Skridufell, "Flossi" for Flosi, "Skriflir" for Skrifla, "Rauthamisolkaldá" for Raudamelsölkelda, "hakarö" for hákarl, etc. The descriptions of the traveller's experiences are written in a lively and entertaining manner, and but few errors can be found. The following, however, should be corrected in a new edition. On p. 109 it is said of the new road from Thingvellir to Reykjavik that it is "the only one of any length in all Iceland, for it is 36 miles long." This is not correct, for the recently made road from Reykjavik to the southern lowland over Hellisheidi has a length of more than 60 miles. On p. 114 the author says that Reykjavik has 4000 inhabitants, whereas, according to the last census, it has 7500. At the same place he says that almost all the business men in Reykjavik are Danes, but, in fact, the majority of tradesmen in Reykjavik and other places in Iceland are natives,* and there are hardly more than five to six Danish families in Reykjavik and perhaps ten to twelve in the whole island. All the officials in Iceland are Icelanders, *without exception*; not one is a Dane. The cathedral of Reykjavik is not built of wood, but of brick.

At the end of the book we find a list by A. W. Hill, of the plants collected during tours in Iceland and the Færoe islands, with some interesting notices of the vegetation on Kjalvegur. The plants named have, indeed, been all found before in these districts, with the exception of *Ophioglossum vulgatum* from Hveravellir; this plant has been previously reported from only two places in Iceland—Gunna on Reykjanes and Bjarnarflag at Myvatn. Of late years the plant-geography of Iceland has received much more attention than previously, especially from the Icelandic botanists Helgi Jonsson and Stefan Stefansson, who have published many articles on their investigations. Helgi Jonsson has also made especial examinations of alga vegetation, while fungi, mosses, and lichens have been the object of investigations by the Danish botanists, E. Rostrup and Chr. Grönlund.

TH. THORODDSEN.

ASIA.

JAPAN.

Henry Dumolard, 'Le Japon, politique, économique et social' Paris: Armand Colin. 1903.

In spite of its unpretentious appearance, this is a work of serious value, and does not present the mere impressions of a tourist like the greater number of modern books on Japan. The author, formerly professor at the Imperial University at Tokyo, claims to have spent over three years in the study, at first hand, of the social and economic conditions of the country, during journeys made through the length and breadth of it, which gave him the opportunity of mixing intimately in the inner life of the people. His views on Japanese questions are thus deserving of careful attention, even though they may not always meet with general acceptance. The separate chapters treat fully of the constitution, politics, administration, industries, commerce, etc., of the country, the conclusion being supported by an array of statistics, which certainly seem to justify them in many cases. The

* According to official statistics there were in Reykjavik, in 1899, 41 traders, of whom 38 were Icelanders, and 200 business houses in the whole island, of which 156 were owned by natives, while the remaining 44 were in the hands of Danes, Englishmen, and Norwegians.

writer takes throughout an unusually pessimistic view of Japan under modern conditions, laying much stress on the poverty of the country, as evidenced by the scarcity of capital, the want of thrift on the part of the people, the drain caused by the constant excess of imports over exports, and so forth. As regards the want of thrift, which he considers proved by the smallness of the deposits per head in the savings banks as compared with the figures for European countries, this is surely not quite a fair conclusion, as the smallness of the deposits would be a necessary result of the poverty of which he says so much. In his general verdict on the state of the country, he adopts the view recently expressed by a native writer, that, in spite of the apparently progressive character of the Japanese, China —that is to say, the mass of the people as distinguished from the government—is in reality the more advanced. In short, he considers that in the so-called modern advance of Japan, it is only the worst parts of Western civilization which have been adopted. It should be mentioned that Dr. Dumolard has been hitherto known as a writer under the pseudonym "Far East."

PERSIA.

'Across Coveted Lands; or, A journey from Flushing (Holland) to Calcutta, Overland.' By A. Henry Savage Landor. Two vols. London: Macmillan. 1902.

Although nominally a description of the whole journey from Flushing to Calcutta, these volumes are mainly devoted to the Persian section of the route—the "coveted lands" of the title, a somewhat misleading expression, for, in themselves at least, the countries described offer little to stimulate the covetousness of neighbouring Powers. Mr. Landor entered Persia by way of Baku and Resht, and from the capital took the route *viâ* Isfahan and Yezd to Kerman. From Kerman he went north, crossing the great Lut desert to Birjand, and thence following the now well-known route through Sistan and northern Baluchistan to Quetta. He does not, of course, claim to have brought back any striking observations from a strictly geographical point of view, for in a country which has been so frequently traversed as Persia, there is little now left for an amateur traveller to accomplish in this direction. He has, however, done some service in improving the popular knowledge of the country, its people and antiquities, many of the photographs with which the book is liberally provided being a decided help in this direction. Mr. Landor crossed the Lut desert at, probably, its most inhospitable part, and, like the few travellers who had preceded him, he and his men suffered considerably from thirst and heat, though the opposite extreme was often experienced by night. His journey, however, was not made, like that of Colonel Stewart (*Proc. R.G.S.*, 1886, p. 141), at the worst season of the year. He seems to have been unfortunate in his camels, who are described as timid, and unhappy when going up or down hill; * whereas some travellers have expressed their astonishment at the composure of these animals when traversing the most desperately steep mountain paths (cf. General Haig's "Journey through Yemen," *Proc. R.G.S.*, 1887, p. 483). Much is said of the ruins met with in various parts, especially those of Zaidan in Sistan, of which a considerable number of illustrations are given. Mr. Landor is perhaps disposed to exaggerate the importance of these ruins, which are not very imposing except for the distance over which they are spread. As Major Sykes has pointed out, they probably, for the most part, represent villages which lined the banks of an irrigation canal, and there is nothing very remarkable in the congregation of the population in this manner, when we consider their dependence on an artificial water-supply in this generally arid region. The author gives

* The Lut is by no means an interminable expanse of sand, but is traversed by frequent ranges of hills.

his views freely on questions of trade and politics, and at times does not stint his criticism on all and sundry who have either written on or travelled in the country. In addition to the photographs, there are some clever sketches by the author's own hand, and it is not always easy to distinguish the two at first sight, especially as, in some cases, a certain amount of manipulation of the photographs has been necessary to secure good prints.

AFRICA.

Madagascar and the Malagasy.

'Histoire Physique, Naturelle et Politique de Madagascar: Livre Premier, L'Origine des Malgaches.' Hachette et Cie., Paris. 1901.
'Madagascar au Début du XXe Siècle.' Paris. 1902.

Since the French occupation of the great island Malagasy studies have naturally received a fresh impulse, and it is pleasant to find the veteran pioneer, M. Alfred Grandidier, still taking the lead with a new instalment of his classical work on the geography and natural history of Madagascar, and on the origin and ethnical relations of its inhabitants. An apology is perhaps due to the learned author for an unavoidable delay in directing our readers' attention to this new section of the work—that devoted to Ethnography—a first part of which was issued by Messrs. Hachette late in the year 1901. The work is as richly "documented" as any of the author's previous publications, with an almost embarrassing abundance of notes and notes to the notes, often overflowing into two or three pages, and leaving but a few lines of the actual text in each.* But it was evidently found impossible to modify by fusion this somewhat awkward arrangement of the subject matter, and the serious student will still be grateful for even an apparent superfluity of valuable data drawn from the most diverse and out-of-the-way oriental and European sources.

M. Grandidier's well-known views on the constituent elements of the exceedingly mixed Malagasy populations remain virtually unchanged, nor, indeed, has later research brought anything to light requiring him to modify the conclusions he had already advanced in the historical section of his work issued some twenty years ago. Recognizing the racial diversity and unity of speech prevalent throughout the island, he regards the bulk of the natives as an amalgam, not of the historical Malays and African negroes, but of the Oceanic Mongols (proto-Malays) and Oceanic Negroes (Melanesians), and traces the common speech, not to a so-called "Malayo-Polynesian," but to a Melanesian source. "La langue Malgache existait certainement, telle qu'elle est aujourd'hui, longtemps avant la venue des Malais, qui sont les ancêtres directs des Andriana ou nobles de l'Imerina [the so-called Hovas], et il n'est pas douteux qu'elle a été apportée par les nègres indo-mélanésiens, dont les immigrations successives ont peuplé Madagascar" (p. 11). This is in substantial agreement with the views held by me in 'Man, Past and Present,' the chief difference being that I bring the negro element, not from Melanesia, but mainly from Africa. It must, at the same time, be admitted that our author's theory, if it could be upheld, would go a long way to explain the astonishing prevalence of a language of Oceanic type amid the mixed Mongolo-Negroid Malagasy populations. The difficulties, however, which prevent a general acceptance of this theory seem to me unsurmountable.

* In several pages (79, 93, 101, etc.) there are only two lines of actual text, and at p. 81 it is crowded out altogether.

On another, and that a most important point, I am glad to find myself in complete accord with M. Grandidier. It has reference to the Semitic immigrations and settlements, which he does not limit with most authorities to late (post-Koranic) times, but traces back to the days of David and Solomon, and even to earlier Idumæan Jews from the Red sea. "La présence d'une colonie iduméenne à Madagascar n'a pas lieu de nous surprendre, car on sait que dès la plus hauté antiquité les Arabes du Yemen [Himyarites] ont fréquenté la côte orientale d'Afrique aussi loin au moins que Sofala, et il est certain que l'archipel des Comores et l'île de Madagascar ont reçu la visite de leurs boutres" (p. 96). This statement, having such a direct bearing on the question of the "gold of Ophir," is all the more valuable, since it is made without any reference to that problem, which is nowhere discussed by our author.

The other racial elements discovered by him amid the present heterogeneous populations of the island are the Persians and later (Muhammadan) Arabs, the East Indians, Japanese, Chinese, Africans, and Europeans. But although treated with exhaustive learning, none of these intruders were numerous enough perceptibly to influence the physique or culture of the natives, and may be regarded as *des quantités négligeables* in the general discussion of Malagasy ethnography.

Another work on the present condition of the island claims special attention, thanks both to the great variety and trustworthiness of its contents. It consists of a series of carefully prepared monographs on the geography, geology, biology, climate, and European colonization of Madagascar, contributed by MM. Guillaume Grandidier (son of M. Alfred Grandidier), R. Blanchard, M. Boule, A. Marre, and other accepted authorities. All these subjects have already been so ably treated by Messrs. Sibree, Dahl, Richardson, and other English writers, both in the *Antananarivo Annual* and in separate works, that a detailed account of the French publication may here be dispensed with. Special mention is challenged by M. Boule's exceptionably able geological paper, where the land connections of the island with Africa and India, first in Triassic and again in somewhat early Tertiary times, is clearly set forth. "Il paraît bien certain, en effet, que Madagascar a eu des relations étroites a la fois avec l'Afrique et avec l'Inde pendant l'époque du Trias. On ne saurait expliquer autrement les ressemblances vraiment extraordinaires que nous avons constatées entre les animaux terrestres et les plantes fossiles des deux continents que sépare aujourd'hui toute l'étendue de l'Ocean Indien. . . . Une nouvelle jonction a du s'établir après les premiers temps tertiaires, car non-seulement l'île paraît être dépourvue des dépôts marins plus récents que l'Eocène, mais encore il faut expliquer le passage des Mammifères oligocènes, particulièrement des Lémuriens qui ne peuvent être que les descendants des Lémuriens de nos gisements tertiaires d'Europe" (p. 62).

Boer and other intending immigrants would be well advised to consult the section devoted to the climate and economic prospects of the island.

A. H. Keane.

'Madagascar. Essai de Géographie Physique.' Par E. F. Gautier. *Maps and Illustrations.* Paris: A. Challamel. 1902.

This work is not, as its title would lead us to expect, restricted wholly to the physical geography of the great African island, for a good third is devoted to an account of the inhabitants, their manners and customs, and other branches of anthropogeography. It is, however, in the larger portion dealing with the physical structure and surface features that the main importance of the book lies, and from this point of view it is the most satisfactory account of the island that has yet appeared. Masterly as have been the sketches of its major features supplied in

various scientific papers of M. Grandidier, we have not yet had from the hand of the veteran explorer the detailed treatment that is here attempted by M. Gautier, who in the mean time is particularly well qualified for the task, by the extent of his own itineraries in Madagascar, and his careful study of all that has been written by others. His work, therefore, not only presents a full summary of existing knowledge, but possesses an original value from his ability to test and amplify the conclusions of others by the results of his own researches. His views may not, perhaps, be always accepted, but they at least merit careful attention as rational explanations of the phenomena observed. The excellent physical maps are in themselves valuable aids to a knowledge of Madagascan geography.

In the first chapter, which discusses the question of "Lemuria," the author does not venture to pronounce definitely between the rival theories that have been brought forward, but he is evidently inclined to give the greater weight to the views of Wallace, and to think that the ancient communication with India and the East was rather by disconnected land masses than by a continuous continent.* The next three chapters describe the geological features, beginning—somewhat strangely, except for the world-wide importance of such action—with the recent manifestations of volcanic activity. It is with the structural orography, discussed in the fifth chapter, that we are more nearly concerned here, but attention may be drawn to the general conclusions regarding past geological history sketched at p. 90. The author shows that the sedimentary strata which abut on the great gneissic plateau on the west, represent four successive stages in the retreat of the sea from that plateau, from Triassic to modern times. The formations, still in the main horizontal, terminate in true escarpments as well marked as those of the Paris basin, though their real character has not hitherto been recognized. As regards the general morphology of the surface, M. Gautier regards the great gneiss plateau as a *horst*, on all sides of which the adjoining parts of the crust have sunk many hundred feet. Though generally called a plateau, the surface is very irregular, but a series of longitudinal folds parallel to the axis of the island can be distinguished, and to this circumstance is due the sudden change from an even line to a broken contour observable when the wall of the plateau leaves its north and south direction. A transverse series of feature-lines exists also, though its presence was long overlooked. There are, in fact, three great systems of transverse valleys, which have had a most important influence on the history of the island. The western sedimentary formations owe their present relief almost entirely to erosion, and here the characteristic lines run east and west, as is shown by the outline of the coasts. M. Gautier, however, ascribes some of the features here, too, to tectonic causes, supposing that a series of transverse faults, of which we have yet no precise knowledge, have resulted in a differential sinking of the crust in parts of this area. The effects of erosion are discussed in chap. vii. (chapter vi. being devoted to a careful consideration of the distinct climatic regions of the island), prominence being given to the great Triassic valley running from north to south, to the importance of which M. Gautier first called attention some ten years ago.

A brief notice must suffice for the remaining contents of the volume, though their interest by no means lessens as we proceed. The distinct regions (due to differences in climate) into which the island is divided from the point of view of its flora are sketched in the eighth chapter, as well as the subordinate variations due to differences of soil, elevation, etc. It is a noteworthy fact that the comparatively luxuriant vegetation of the east is due solely to the more plentiful rainfall,

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* The argument based on the discovery of Cretaceous fossils on the east coast of Madagascar does not, however, tell against the idea of a still earlier connection.

for the covering of humus overlying the unfertile laterite is often very scanty. An instructive study of the coasts of the island is next given, their varying characteristics, and the influence which these, as well as the direction in which they face, have had on the history, being well brought out. In discussing the origin of the Malagasy, M. Gautier adopts M. Grandidier's views as to their Melanesian affinities, but comes to no decision respecting the Hovas (Merinas), whose language he thinks has been adopted from the conquered Malagasy. Whether Malay or not, their conquest was only one among many similar episodes, and he considers their predominant position to be the result of the special character of the district in which they settled.

South Africa.

'South Africa and its Future.' Edited by Louis Creswicke. London and Edinburgh: T. C. & E. C. Jack. 1903.

There is much in this volume which may help the general reader to form some estimate of the prospects and resources of South Africa, a question which more than any other engages the attention of the public at the present time. It consists of a series of articles by different contributors on the special branches of the general subject, including the questions of emigration, mining, agriculture, commerce, and the like. The greater number of the contributors write in a decidedly optimistic spirit, and many will, no doubt, consider that they have left too much out of view the inevitable difficulties in the way of future development. This, however, is a fault—if such it be—on the right side, for the mere fact that a hopeful view is shown to be possible must be to some extent a help to progress. The importance of a properly organized system of emigration is forcibly shown by the Duke of Argyll, who points to the almost inexplicable lack of effort in this direction in the past, and the especial need for the sending out of white women to South Africa. In the chapter on Mining an elaborate calculation is made of the probable total value of the exploitable gold deposits, which is put at the high figure of some 2800 millions, while the opinion is expressed that the new conditions will act strongly in favour of the industry. Little attention is paid in this chapter to the effect of such a development on the prosperity of the community at large, the subject being considered rather from the special point of view of the industry itself. The chapter on the agricultural outlook, by the editor, deals with possibilities of which the benefit to the community at large is less open to question, and here, too, an extremely sanguine view is taken, which will certainly not be accepted as final in all quarters. Mr. Creswicke has great faith in the possibilities of irrigation, which he considers may add 3,000,000 acres to the cultivated area, in addition to a possible extra 10,000,000 acres dependent on rainfall only. Mr. Bleloch's chapter on railways contains some useful statistics, though the accompanying map is not quite up to date. Mr. Eglinton's contribution on commercial prospects is likewise written in an optimistic vein, but the arguments occasionally appear somewhat superficial. What valid conclusion, *e.g.*, can be derived from the strange supposition that the total value of the imports from Great Britain, divided by the total number of the black population, gives an indication of the actual, or even possible, purchases per head of such population, the same figure divided by the number of whites being also taken to give the amount spent by each white man? If, however, we may take as even approximately correct the estimate that in five years' time the mining industry alone will involve the annual expenditure of £50,000,000 on stores, machinery, wages, etc., the prospective advantages to the manufacturers of this country, provided they show themselves equal to the occasion, must certainly be beyond dispute.

MATHEMATICAL GEOGRAPHY.

Azimuths of the Pole Star.

'Azimuths of the North Pole Star, Lat. 38° N. to Lat. 55° N., for use until the year 1915.' By Sidney A. Roberts (Dominion and Provincial Land Surveyor). Victoria, B.C.: Thos. R. Cusack. April, 1902. *Price* $2.

As the pole-star is not situated exactly over the North Pole, or in a direct line with the Earth's axis of rotation, whenever it is used for the determination of latitude of azimuth, certain corrections have to be made, which add considerably to the work of computation. As regards latitude, the necessary corrections are given in the Nautical Almanac, and are readily applied to the observed altitude; but the surveyor who wishes to mark off accurately the north and south line by means of the star has hitherto had to go through a fair amount of figuring before he can do so, unless he has at hand some table of the azimuths of the star for certain hour angles and latitudes, such as that given in the French 'Connaissance des Temps.' This table, however, besides other disadvantages, is only correct for one year, and is not generally accessible. Realizing these facts, Mr. S. A. Roberts, a Dominion and Provincial land surveyor of British Columbia, four years ago published a table which gave the azimuths of the pole-star at certain intervals of time for the years 1899 and 1900, for use between lats. 48° and 54° N., which proved of considerable service. He has now issued a second edition, which is a great improvement upon the former, not only from the fact that the limit of latitude has been extended so that the table can be used between lats. 38° N. and 55° N., but on account of its being available for a considerable number of years—until 1915. The method by which this latter advantage has been secured is interesting and ingenious. First a table of azimuths of the star has been computed for different hour angles and every degree of latitude with an assumed polar distance of 1° 11′ 40″, and then there are two tables from which corrections are obtained to be applied to the quantity taken from this general table, due to the difference between the assumed polar distance 1° 11′ 40″, and that given in the Nautical Almanac for the date. The first of these latter tables gives the correction in azimuth for each degree of latitude for an hour angle of $5^h\ 59^m$, and then with the quantity thus obtained the second table is entered, and the required correction found for the hour angle of the star at the time of observation, and applied to the azimuth taken from the table computed with a polar distance of 1° 11′ 40″.

The whole process does not take long, and after the hour angle of the pole-star has been computed, a surveyor can, in a very few moments, put his instrument in the true meridian with a fair amount of accuracy, although for astronomical work, such as the determination of longitude by moon culminating stars, it must only be considered as a first approximation, and the more exact methods, such as high and low stars, should be finally employed. The angles are given to the nearest tenth of a minute of arc instead of seconds.

There can be no doubt that Mr. Roberts' tables will be found of service to surveyors in Canada and the United States, for whose use they have been specially prepared; and, indeed, they could often be used with advantage in any part of the world included within the stated parallels of latitude.

OCEANOGRAPHY.

The Oceanography of the "Valdivia."

'Wissenschaftliche Ergebnisse der Deutschen Tiefsee-Expedition auf dem Dampfer *Valdivia*, 1898–1899.' Im Auftrage des Reichsamtes des Innern herausgegeben

von Carl Chun. Erster Band. Oceanographie und Maritime Meteorologie. Im Auftrage des Reichs-Marine-Amtes bearbeitet von Dr. Gerhard Schott. Jena: Gustaf Fischer. 1902. Two vols. Text and Atlas.

All concerned in the production of these splendid volumes deserve credit for the result of their labours. Dr. Schott, who was the oceanographer, and later also the meteorologist, of the expedition on board the *Valdivia*, has had the good fortune of being charged with the discussion of the data he collected, and with seeing it printed on a spacious page giving full scope for the most luxurious tables and diagrams. He has been able to produce a series of maps showing the distribution of each element of the observations, to which the letterpress is subsidiary in importance. These maps utilize the work of the *Valdivia* only to supplement and correct previously ascertained data, hence they really give an epitome of existing knowledge regarding the oceanography of the Atlantic and Indian oceans; and as they are all drawn on an equivalent area projection, they are available for the calculation of relative areas by direct measurement.

The cruise of the *Valdivia* has been described in this *Journal* (vol. xii. 404, 569; xiii. 297, 336, 640), and a comprehensive preliminary paper by Dr. Schott on his department of the work has also appeared (vol. xiv. 518), so that it is unnecessary to recapitulate the incidents of the voyage, or its general results. We are presented here with a detailed account of the instrumental and mechanical equipment of the ship for oceanographical work, followed by clearly subdivided chapters on the Depths, Temperature, Salinity, etc., and Currents of the seas that were traversed, and also on the Meteorology of the cruise, these chapters supplying not only results, but also the actual observations set out in full, and expressed in curves and profiles as well as in figures. It is thus possible to see what the *Valdivia* did in each department, and how far her work adds to the sum of knowledge.

The 186 deep-sea soundings are placed on a map on which all other accessible data had been inserted in metres to the nearest hundred. The isobaths were then drawn so as to yield what is really a new bathymetrical chart of the whole Atlantic and Indian oceans. The only part left blank for want of data is the region east of South Georgia, where the *Antarctic* and *Scotia* are now at work. Perhaps the most interesting feature added to the Atlantic is the Valdivia bank on the Walfisch ridge (as Schott terms it), which gives new definiteness to the separation between the West African and the South African depressions, the latter itself also rendered far more definite by the *Valdivia's* soundings on her way to Bouvet island. In the Southern ocean the great extension of the deep sea was an important gain; but there is no use at present speculating on the configuration of that region, as the *Gauss* and *Discovery* have already added to and modified the *Valdivia's* results. It may possibly be that the Marion and Crozet islands will be found to be connected by a ridge, or at least by a less deep part of the ocean. Dr. Schott believes that the great Indian-Antarctic basin, discovered by the *Valdivia*, indicates an extension of very deep water far within the antarctic circle. The *Gauss* will certainly throw light on this point. The mean depth of the South Indian ocean, so far as it can be arrived at, is twice as great as Karstens estimated it in 1894. Considerable additions have been made to our knowledge of the detailed configuration of the Indian ocean, the structure of which, once believed to be very simple and uniform, is gradually being shown to be extremely varied and complex.

Many plates in the atlas are devoted to the mapping of the temperature of the water, and those form, perhaps, its most important part. As one turns over sheet after sheet one realizes more and more fully how the voyage of the *Valdivia* has furnished an opportunity for increasing the data of oceanography.

Besides a map of mean surface isotherms of the two oceans, there are isothermal maps for the depths of 50, 100, 150, 200, 400, 600 and 800 metres. Similar maps are familiar to readers of Dr. A. Buchan's discussion of oceanic circulation in the *Challenger* Reports; but these were for different intervals of depth, and Dr. Schott has drawn his maps *de novo* from the original material. It would be interesting to compare the two sets of maps and to discuss the necessity of duplicating so vast a mass of recent work; but it is just here that we in the British Isles feel the effects of our scientific isolation. We cling to our fathoms and our Fahrenheit degrees because they are familiar to us, and we try to justify the attitude by pointing out certain inherent elements of superiority they possess over meters and Centigrade degrees. As far as reaching the attention of continental men of science is concerned, we might as well write in Gaelic; and Dr. Schott, rather than attempt to interpret the existing maps, has translated all the original temperatures and depths to the continental standards and mapped them afresh. In the present case the diversity of notations (a far greater barrier than the diversity of languages) is the more to be deplored because the author gives a flat denial to some of the conclusions which Dr. Buchan believed he had fully established, and looked upon as of great importance. Dr. Schott also complains that the 1000 temperature observations of the German ship *Gazelle* were not utilized in preparing the *Challenger* charts. In any case, and for whatever reason, we are confronted with the fact that a great piece of scientific work has been done twice over. Careful comparison will doubtless reveal more confirmation than contradiction in the results of each.

There are also maps showing the position in depth of several of the more important isotherms over the oceans, and a detailed study of the upwelling of deep water along various parts of the African coast, which seems to be remarkably well done. We note, by the way, with some satisfaction that Dr. Schott cannot find two German words which shall distinguish between water of different origin homogeneously mixed together and water of different origin flowing in separate though contiguous and inter-crossing streams. It is rarely that the English language yields readier terms for confluent phenomena than German can supply, but in this case we could at least distinguish the waters as *mixed* in one case and *intermingled* in the other.

The temperature data are also expressed in curves and profiles, some of which are of very great interest. Those in the far south, where the alternate layers of warmer and colder water characteristic of the Antarctic regions appear, will attract particular attention. Judging from the appearance of the curves of change of temperature with depth, the observations made on board the *Valdivia* seem to have been of satisfactory accuracy.

In applying his results to the question of the cause of oceanic circulation, Dr. Schott finds that the movement of the surface of the sea is the cause of the movements at all depths, for as Varenius, with his mastery of principles and his terseness of expression, put it centuries ago, *Si pars oceani movetur, totus oceanus movetur.*

There are many problems touched on in this volume and atlas to which we would like to refer. Amongst them we may note the discussion of the influence exercised on the respective oceans from the outflow of the Mediterranean and the Red sea, and of the cooling influence exercised by the Antarctic seas on the waters of all the oceans. Space, however, forbids further comment, nor will it permit more than a mention of the beautiful maps of salinity and of density, and the discussion of the meteorological observations. We must end as we began, by congratulating Dr. Schott on the way in which he has taken advantage of his opportunities of work afloat and of study ashore, and on the admirable result he has achieved.

H. R. M.

HISTORICAL GEOGRAPHY.

The Roman Empire.

'Murray's Handy Classical Maps.' Edited by G. B. Grundy. 'The Roman Empire.' London: Murray. 1s. *net.*

The plan of these maps, with their clear printing and distinction of epochs, seems to be excellent. One map, with features of relief distinguished by tints, is placed side by side with another untinted, except along the frontier lines of the Empire. On so small a scale equal clearness probably could not have been attained otherwise. To have printed one map on tissue paper, and to have allowed it to fall precisely upon the other, would have been even better, had durability not had to be considered. A complete index is added. One cannot help noticing, however, considerable unevenness in the accurate delineation of detail in the upper map. On so small a projection this might be disregarded, were it not that a minute accuracy is evidently aimed at in certain parts. One must therefore ask why, if the three high points of Crete are all specially shaded, the great Mesaorea plain of Cyprus is tinted as uniformly over 600 feet? Why a broad belt of green runs all round the north and west of Asia Minor, often as in reality the coast is fringed by high ranges? Why, among mountains rising over 3000 feet, there is no indication of Taygetus, or the Eubœan range, or the higher points of the lesser islands (which, indeed, all appear as under 600 feet)? Why, among points over 9000 feet, Olympus, the Rila Dagh, Liubotrn, the Van volcanoes, and Sahend do not appear? And why, on the other hand, Hermon and the inner range of Midian do appear in the highest category? In regard to the lower map, there is nothing to criticize of any importance. Oxyrhynchus is on the wrong side of the Bahr Yusuf, as in the upper map also. We suppose that the editor's plan is not to take account of additions to the Empire after 100 A.D., and that for this reason Dacia and the trans-Euphratean conquests of Trajan are not included within the tinted frontiers.

D. G. H.

Historical Atlas.

'A New Students' Atlas of English History' By Emil Reich. Macmillan & Co., London and New York. 1903 10s.

This is a series of what Dr. Reich calls "plastic maps," with notes and index, for the use of students of all ages. The main idea is to suggest the movement of events and their dynamic nature by coloured lines and arrows—in itself an admirable idea, and worked out here as fully as is consistent with clearness on such a small scale. But as these maps contain no hill-work or suggestion of contours, they are hardly sufficient by themselves to express history in terms of geography. Dr. Reich's idea, in fact, ought to be further applied to maps on a larger scale, and, if possible, to relief models. For the present instalment, however, we are duly thankful. The maps in the great majority of cases show military movements—that majority is rather large for a series based avowedly on J. R. Green's 'History'—but there are also others showing the progress of enclosure and discovery, the distribution of fiefs and abbeys. We might have expected one at least showing the growth of towns, and would have exchanged for it the three illustrative of British genius. For one may fairly question the standard adopted to determine that rare quality. Dr. Reich relies on the 'Dictionary of National Biography,' *i.e.* on Sir Leslie Stephen and Mr. Sidney Lee, very good authorities indeed, but not conclusive.

D. G. H.

The First German Voyage to India.

'Balthasar Springer's Indienfahrt 1505–6. Wissenschaftliche Würdigung der Reiseberichte Springer's zur Einführung in den Neudruck seiner "Meerfahrt" von Jahre 1509.' Von Franz Schulze. Strassburg: Heitz. 1902.

The voyage to India of Balthasar Springer (by some also written Sprenger *) is of special interest, as the first undertaken by Germans after the sea-route had been opened up by Vasco da Gama. Before 1505 the merchants of Italy had already gained an entry into the new field, but it was only after the despatch to Lisbon, by the Welsers of Augsburg, of their agents Simon Seitz and Lucas Rem in 1503 and 1504, that similar privileges were conceded to the Germans. As a result of the agreement concluded by Rem in 1504, three ships were fitted out by the merchant princes of Germany, and on their sailing with the fleet of d'Almeida in 1505, two German factors, Hans Mayr and Balthasar Springer, went out in them. Mayr wrote an account of the voyage, which has remained in manuscript, but Springer's work was printed, though each of the three editions is extremely rare. It has long been felt that the work was worthy of a reprint, and this has now been supplied, in facsimile, in the work quoted above.

This work, however, is much more than a mere re-issue of Springer's text and illustrations, for the editorial matter forms three-quarters of the whole, and includes careful studies of Springer's life-history (so far as it is known), of the circumstances under which the work was published, of its contents, and of the position to be assigned to the author as an original contributor to knowledge. In some of his conclusions, the editor merely follows Harrisse and others, but of other doubtful questions he attempts an independent solution. By careful inquiries at most of the great libraries of the world, he has come to the conclusion that only four copies of the larger German edition (the one now reprinted) exist at the present day, and one of these is imperfect. There is a Latin version, of which a manuscript has lately been found at the University Library at Giessen, it having previously been known only from a printed copy put in, as a make-weight, in the second volume of the 'Voyage Littéraire de deux Religieux Bénédictines' (Martène and Durand), published in Paris in 1724. Herr Schulze gives reasons for thinking that this was printed from the actual manuscript now at Giessen, as blanks have been left in passages where the writing of this is illegible. He thinks that this Latin version was merely a report to Springer's employers, which was subsequently published in German in a more popular form, first as an explanatory text to the seven woodcuts by the Augsburg engraver, Burgkmair (the smaller German edition), and afterwards more in full, with thirteen woodcuts, in the larger German edition. Herr Schulze makes a careful analysis of the contents, showing what a large amount of information on the countries visited (including the African coasts), is supplied by Springer, who, though not an educated man, was an intelligent and capable observer. He also undertakes a detailed comparison with other works from which, conceivably, Springer might have borrowed his information, especially the German translation, by Ruchamer, of the rare Italian collection, 'Paesi novamente retrovati . . .' (1507).† The result, in his opinion, is to show that the agreements bear so small a proportion to the differences, that there is no valid reason to doubt the originality of Springer's work.

* Herr Schulze shows that the balance of evidence is in favour of Springer as the correct form.

† In quoting the title of this, he omits the last word, "intitulato," and so fails to make sense. The full title is, 'Paesi novamento retrovati Et Novo Mondo da Alberico Vesputio Florentino intitulato.'

THE MONTHLY RECORD.

EUROPE.

Altitude of Trees on the Cairngorm Mountains.—In a paper read before the Andersonian Naturalists' Society of Glasgow in November last, and printed in the *Cairngorm Club Journal*, vol. iv. No. 20, January, 1903, Mr. H. Boyd Watt gives some notes on the altitudes above the sea reached by various species of trees in the Cairngorm mountains. Mr. Watt's own observations have been made principally in the forests of Abernethy and Rothiemurchus, on the northern side of the range, and in various glens of the Braemar district, on the south; but he also embodies observations made on his behalf at Tomintoul, east of Abernethy. The height at which the Scotch pines die out seems to be about 1500 feet, though both these pines and larches reach nearly to the summit of Creag Choinnich at Braemar (1764 feet). The birch is the only other tree which attains this altitude, and this seems to hold its own better than the Scotch pine. Above 1500 feet, in the Braemar birch woods, the trees, though well proportioned, are often not more than 6 feet in height. In the Morrone wood—a typical birch one, with an undergrowth of heather, juniper, and bracken, though Scotch pines appear in places—there are occasional aspens up to 1500 feet. Mr. Watt gives a list of other trees found above 1100 feet (the altitude of Tomintoul is 1160), from which it appears that the lime, sycamore, laburnum, wild cherry, ash, elm, alder, hazel, and at least two willows occur between 1100 and 1200 feet, while the mountain ash, hawthorn, horse-chestnut, and beech reach at least 1100. Most of the last named are, of course, introduced.

The Snow-line in Norway.—Norway is rightly called a snowy land. In the south snow covers the ground for only two to three weeks, but further north it remains much longer, at Røst two or three months, and at Vadsø half the year. It has been reckoned that 2·5 per cent. of Norway is covered with permanent snow, but this is certainly too high an estimate. According to Helland, fully 5000 kilometres (1430 square miles) are buried in snow throughout the year, of which the Jostedalsbræ accounts for 330 square miles, or, with the closely adjacent glaciers, 483 square miles, while the Folgefond, Svartisen, Aalfotbræ and Frostisen have an aggregate area somewhat less than this. The remainder of the permanent snow is scattered over the country in small patches. Dr. A. M. Hansen (*Norske Geogr. Selsk. Aarbog*, 1901-2) has compiled a map of snow-lines, taking as limit the level to which glaciers under the most favourable topographical conditions descend on an average. These lines show clearly that the snow-line thus defined rises considerably towards the interior. The snow-line contours run on the whole parallel to the coast—south-south-west to north-north-east—and are not determined by the latitude. Glaciers first appear at a distance of 25 to 30 miles from the coast, and here end at a height of 600 metres (1970 feet). The other contours run nearly parallel to this till a height of 1800 metres (2600 feet) is reached in the country between Jotunheim and Rondene. Where the large fiords penetrate into the land the contours are thrown eastwards. A comparison of these contours with a temperature chart shows that the snow-line stands in no direct relation to the mean annual temperature, and that where the winter is mildest, along the coast, the snow-line is lowest. The summer heat, however, has a marked effect on the height of the snow-line. The precipitation reaches a maximum along an axis lying about 50 miles from the coast, and amounts to about 79 inches south of Stad, and 39 inches and over in Nordland. On the whole the rainfall contours accord with those of permanent snow, the snow-line lying highest over the drier continental side of the country.

Certain exceptions, however, may be noticed, and it must also be remembered that heavy summer rains are very effective in washing away snow. The height of the snow-line seems, then, to depend on the summer heat, which melts the covering of snow, and the winter rains and snow. Accordingly it is lower near the coast where Atlantic cyclones with heavy winter precipitation prevail, and high in the interior where the winter is dry and rain falls in summer.

The Highest Mountain in Sweden.—Until recently little was known of the elevation of the country in Swedish Lapland, and until the end of the seventies the Sulitelma group was considered to be the highest elevation in Sweden. In 1879, however, the Sarjetjåkko was ascended by Bucht and its height, measured by two aneroids, was found to be 6980 feet, or 804 feet greater than that of Sulitelma. Afterwards another claimant was found for the honour of being the highest summit, the Kebnekaise, but the measurements taken were not accurate enough to settle the question. In 1896 Prof. P. G. Rosén spent two weeks in the neighbourhood, when, however, the atmospheric conditions were unfavourable and the highest point of the Kebnekaise rarely visible. He was able to complete his survey in 1902, when he fully determined the height and position of the mountain. His heights are—Kebnekaise, 6964 feet; Sarjetjakko, 6855; Kaskasatjåkko, 6809; Stuor Niak, 6302. These and lesser heights, given in *Ymer*, No. 4, 1902, are marked on the topographical map of Norrbotten, on the scale of 1 : 200,000.

Canals in Belgium.—It is proposed to bring the Limburg coalfields into direct water-communication with the Schelde, the scheme being to rectify the course of the Rupel and Nethe, connection being made with the latter river and the Campine canal. It is considered probable that, in order to carry out this plan effectually, it will be necessary to deflect the course of the Rupel for about 5 miles between Boom and its meeting with the Schelde, and as soon as this is definitely settled, junction will be effected between the Rupel and the enlarged Willebroeck canal, which connects Brussels, Malines, and Antwerp. Another canal under consideration is to connect the small town of Selzaete with a point on the Schelde some 10 miles above Antwerp. This would bring Antwerp and Ghent into navigable communication, the latter being already connected with Selzaete by the Terneuzen canal.

ASIA.

The Morphology of the Coasts of the Sea of Aral.—Describing the coasts of the lake in the *Annuaire Géol. et Minéral. de la Russie*, vol. v. Nos. 6 and 7, Mr. L. Berg divides them into four types—jagged, regular, and embayed coasts (the *gelappte, glatte*, and *gebuchtete Kusten* of Penck , and alluvial coasts at the mouths of rivers. To the first type belongs the northern coast from Karatamak to Sari-Cheganak bay. It is divided by the peninsulas of Kulandi, Karatyup, Chubar, and Kuk Ternak into five gulfs of considerable breadth, where depths of nearly 100 feet were sounded, while in the middle of the sea no depth over 77 feet was found. The steep northern bank, 490 feet above the water, consists of horizontal strata of Lower Tertiary age. They are not dislocated to any great degree except on the southern shore of the Kulandi peninsula. Other types of coast occur also in particular parts, and the effect of abrasion is clearly marked on the friable argillaceous rocks, considerable masses of which fall into the sea and form submarine terraces which would shelter the coast from further attacks, were it not for the rise in the level of the water, which of late has amounted to about 8 inches annually. Owing to the dryness of the climate there is hardly any erosion by rain, and the cliffs present a perpendicular front to the water. The surf is also assisted in its work of abrasion by the mantle of ice which lies on the

northern coast from the middle of December to the end of April, attaining in severe winters a thickness of 3¼ feet. When it breaks up and is carried along by the current, it cuts like a saw into the face of the cliffs. The western shore extends for a distance of 150 miles along the steep margin of the Ust-urt plateau, with a height of 520 feet. Along this stretch it contains not one bay of any depth—only on a large-scale map are any sinuosities perceptible—and not a single island lies off the coast. At the foot of the declivity lies the deepest hollow in the Sea of Aral, with depths of over 100 feet and a maximum of 223 (see map in vol. xix. No. 4, p. 504). The banks are composed of marls and limestones of the middle and lower Sarmatian series. The eastern shore south of the mouth of the Sir Daria is sandy, and hard rock is nowhere visible. The coast-line is broken by numerous small and shallow inlets, a mile or less in length, while the largest, the Bik-tau, has a length of 15 miles and a breadth of 2. The low eastern coast is the bed of the old Aralo-Caspian sea modified by eolian agents. It is studded with shallow basins with smooth clayey bottoms (*takiri*) and wind-blown parallel ridges enclosing hollows. When the sea rises, as it is now doing, it makes its way, with the assistance of the wind, through the intervening low ridges, and converts the basins and hollows into winding inlets, while the promontories along the shore are cut off from the mainland and become islands. The growth of the Sir Daria delta can be traced with great exactness, for it has been surveyed four times from 1847 to 1900. The funnel-shaped mouth, which in 1847 extended to a length of 6 miles, with a breadth of 2 miles and a depth of 10 feet, has been silted up, and the delta has been pushed far forward into the sea. It is estimated that the area of the delta has been enlarged during the interval by 14¼ square miles. On the south coast are regular shore-lines with deltas stretching out into the water. L. Berg's illustrations show remarkable examples of abrasion, deflation, etc.

Bolaäng-Mongondo in Celebes.—By the agreement of 1895 the boundary between the Dutch province of Minahassa and the autonomous state of Bolaäng-Mongondo was defined as following the Poïgar river to the Celebes sea and the Baiyas or Buyat river to Tomini bay. It was subsequently ascertained that the Poïgar rises in the Danou Moöat, and that the sources of the two rivers are not near together. To gain some knowledge of the frontier lands, Heer A. C. Veenhuizen set out in April, 1900, from Amurang, and, passing Poöpo in Minahassa and ascending the Ranoiapo, crossed the Gunung Senayap or Sinayap into the Poïgar basin. On his way up the latter river through very hilly country, he turned for a short distance along the path to Poöpo in Bolaäng, to examine some warm springs at a high temperature, which in dry weather give out such powerful sulphur fumes that it is impossible to pass by them. Then he continued his journey to the Danou Moöat, which has a length of nearly 3 miles and a maximum breadth of 1800 yards. Its surface lies about 3350 feet above sea-level. The temperature of the water was 68° Fahr. in the morning, and 93° at noon. Perhaps the warmth of water in the morning is due to warm springs, for the neighbourhood is volcanic, and weathered pumice-stone lies above the clay soil to the depth of an inch. To the west of the lake rises the Ambang, an extinct volcano some 6000 feet high, on the summit of which is a crater lake 9 or 10 acres in extent; and to the north of it the much lower Pinupulan ("Sulphur mountain"), which seems to be the western side of a crater. Following a route to the left of the Poïgar river, Heer Veenhuizen ascended the Limbut to a height of 5500 feet, only a few yards from the top, and also the Gunung Damar, so named from the resinous trees which grow on it, and reached the town of Poïgar on the coast. Thence he turned up the basin of the river again, exploring some of the tributaries of the right bank, and crossed the watershed towards the Ranoiapo at a height of 3120 feet, where it was seen that Poöpo (Min.)

lies nearer to the Poïgar than it is marked on maps. He also visited the little Ilooloi lake through which the Poïgar flows from south-south-east to north-north-west. It lies at an elevation of 2895 feet, has a length of 440 yards from north to south, with a maximum breadth of 550, and is 62 feet deep in the middle. The Sinayap was again crossed at a height of 3510 feet, and Poüpo (Min.) was found to lie 1010 feet above sea-level. Heer Veenhuizen made another excursion to locate the sources of the Buyat. He ascended the Sekuyung, its tributary the Pinangatoan, and the Pinangatoan-kiri to the Gunung Tokulon, and found the highest source of the Buyat on the southern side of this mountain at a height of 4300 feet. Thence flows the Buyat-kiri, which, uniting with the Buyat-kanam at a height of 2720 feet, enters the Tomini bay immediately to the north of the little Rachun island.

AFRICA.

The Du Bourg de Bozas Expedition: Death of the Leader.—After almost completing his projected journey across the continent, the Vicomte du Bourg de Bozas has, we regret to say, lost his life—from fever, it is said—during the journey from the Nile to the lower Congo. Few recent expeditions have resulted in greater benefits to science, for M. du Bourg's party was carefully organized, and included experts in the several branches of scientific study, each of whom was able to devote himself to his own special subject. The early death of the young traveller—a scion of one of the oldest French families—is, therefore, a serious loss to the cause of African geography. Details respecting the last stage of the journey have not yet been made known, but the narrative of the second section, from Adis Abbaba to the Nile, which appears in the February number of *La Géographie*, and of which an advance proof has courteously been forwarded to us by M. Rabot, enables us to supplement the brief account given in our January number. The route south to the Omo and Lake Rudolf was chosen so as to avoid, as far as possible, the routes of previous travellers, though some of the ground had previously been covered by the Erlanger-Neumann Expedition (among others), of the results of which M. du Bourg does not seem to have been aware. After passing through the populous province of Gurage, the expedition struck south-east for Sidamo, east of the chain of lakes, a visit being paid *en route* to the fertile district of Kambata, and an examination made of two of the aforesaid lakes. M. du Bourg's description of the lakes is somewhat difficult to fit in with those of previous travellers, some of the number being unaccountably omitted. The two first visited are spoken of as Shalla and Abassa, apparently the Shale and Abassi of Neumann; but nothing is said of the lake Lamina, placed by the latter, as by Wellby and Harrison, immediately to the south of Shale. As, however, it is stated that the level of Shalla has lately risen, it seems possible that it now forms one sheet of water with Lamina, though from its delineation on M. du Bourg's map, it is more probable that it represents the latter only. Abassa, too, is said to have lately transgressed its banks, as shown by the dead trees standing in its water. This is pure and good, although there is no outlet, and is extremely clear, whereas the water of Shalla is green from minute algæ. The lake to the east of Abassa, to which no distinctive name was given by Neumann, is spoken of as Oitu, and is, besides, very much smaller than the eastern Abassi of Neumann. Lake Abbaye, to the south, which is very shallow near its northern shores, shows signs of recent retreat. Its waters are very muddy. M. du Bourg states that it is drained by the Sagan or Galana, making no mention of the intermediate lake Chalo or Gangjule, to which, indeed, the itinerary did not extend. All the lakes are said to be quite distinct, no traces of a former connection in the form of lacustrine sediments being found in

the intervening country. In Walamo, traces of the occupation of the country by Mohammed Granye were seen in the form of stone columns, probably the remains of tombs or temples. Hence the route led west across the Bilatti, the main feeder of Abbaye (known higher up as Wera, evidently the Waira of some former maps), to Sidamo, the people of which are described as more civilized than their neighbours, and the country as rich. The expedition then went south and west across the mountainous country between Abbaye and the Omo, finally following the river down to Rudolf. A recent retreat of the waters of the lake was noticed, but this is thought to be merely seasonal, as the lake was reached at the close of the dry season. Its eastern shores are said to be well wooded and populous. The march was continued south-west through the Turkana and Karamoyo countries, the water-parting between Lake Rudolf and the Nile being crossed on a plateau 5230 feet above the sea. In the Turkana country all the river-beds were called "ruzi" by the inhabitants. Near Mount Torror, an isolated peak 6500 feet high, the Igiai—a tribe similar to the Turkana, but less savage—were met with, and afterwards the Utumur, a small and timid race, the last of the group which speaks the Puma language. The last part of the route led through the Shuli country. Notes are given on the geology, fauna, and climate of the countries traversed. From Adis Abbaba to the Turkana frontier the rocks were all eruptive, but the lower Omo valley is covered by recent alluvium, probably laid down on the floor of a vast lake, and in this were found the numerous remains of mammalia already alluded to (*ante*, p. 80). Beyond the Turkana-Karamoyo frontier the country consisted of granite, with its natural accompaniment of laterite.

The Tribes of Eastern Uganda.—As the first of a series of "Occasional Papers" to be issued by the Anthropological Institute, a sketch of the various races dwelling in the region between the Victoria lake and Mount Elgon has been supplied by Mr. C. W. Hobley. The bulk of the work is of more special interest to the ethnologist, as it deals with the customs of the tribes, their subdivisions, languages, etc.; but the first chapter is devoted to the wider subject of the affinities and past movements of the main racial groups. The peoples described are classed by Mr. Hobley under the four heads of Bantu Kavirondo, Nilotic Kavirondo, Nandi, and Masai groups. The route by which the first-named entered the country is somewhat doubtful, it being possible that they came either from the west through Uganda, or from the south, from Unyamwezi along the eastern side of the lake. Mr. Hobley inclines to the latter opinion, as both physically and mentally the Bantu Kavirondo show great differences from the Baganda, while the existence of Bantu peoples, speaking closely allied dialects, on the islands at the mouth of Kavirondo bay and on the mainland further south supports the idea, as does also the fact alluded to at the end of the work, that a similarity is observable with the language spoken in Unyamwezi. Indications of northward movements, continued to the present day, are also to be observed.* The invasion of the Nilotic Ja-Luo, who occupy both shores of Kavirondo bay, is considered as having taken place at a later date, and to have been, in fact, the cause which checked the Bantu movement by leading to the occupation of the narrow Kitoto plain, which intervenes between the lake and the Nandi escarpment. The origin and southward migration of the Nandi-Lumbwa group are matters of uncertainty, but it seems probable that, like the Masai, these stocks are a result of intermixture between Nilotes and Hamites, the Hamitic strain being, however, less

* While assigning to the Wanyamwezi a tendency to a south-to-north movement. Baumann ('Durch Massailand,' p. 238) considered that the Bantu tribes on the east of the Victoria lake had moved in a contrary direction.

marked than in the Masai. Their migration probably took place at a fairly remote period, and it seems likely that their former habitat, like their present, was an upland region. The Guasangishu—the only section of the Masai included within the area dealt with by Mr. Hobley—have given up the nomadic habits of the race, and now live in scattered settlements among the Kavirondo, Nandi, etc. The Eldorobo (Wanderobo of other writers) seem to be survivors of an aboriginal race, which Mr. Hobley is rather inclined to compare with the Nandi—whose language they have adopted—than with the Negrillo or Pygmy races. The general survey closes with a comparison of the characteristics of the Kavirondo and Nandi groups as resulting from the differences of their habitats, the cold and fogs of the high Nandi plateau being considered to have acted detrimentally on the temper and physical development of its inhabitants.

The Sabi River as a Waterway.—Mr. Stanley Hyatt, whose map and description of Eastern Mashonaland appeared in the *Journal* for May, 1902, has returned to East Africa, where he has made a study of the capabilities of the Sabi river for purposes of navigation. He writes to us as follows: "The Sabi and Lundi rivers join at a point on the Anglo-Portuguese border some 170 miles from the sea-coast. Above this junction the Sabi carries a considerably larger volume of water than its neighbour, the proportion under normal conditions being about two to one. Both rivers are of the same general character, having broad sandy beds and precipitous banks. However, some 6 or 8 miles above their junction there is a rapid change in the level of the country, which, in the case of both rivers, causes rocky cataracts, rendering these portions of the streams quite impassable. Below its junction with the Lundi, the Sabi follows the general direction of the former river, the bed becoming considerably larger, but still remaining of the same sandy character. From this point onwards there are no further rapids. The width of the Sabi varies greatly at different points, the bed becoming in some cases as broad as 1½ mile, in others narrowing down to half a mile. There are a considerable number of islands, some little more than large sandbanks, others many hundreds of yards long and covered with large trees. During the summer months the river fills its bed from bank to bank, and from January to April there will be an average depth of 7 feet in the centre of the stream, while in many places it may reach a maximum of 18 feet. At the end of the wet season the stream rapidly diminishes in width, covering but a small portion of the river-bed, and rarely flowing in a single channel. Roughly speaking, at the beginning of July the stream has an average width of 250 yards and depth of 3 feet. Later in the season the water sinks still further. It is impossible to give any fixed estimates as to the depth and width of the Sabi at various points, on account of the shifting nature of the sand, and the great variations in the yearly rainfall. The river is always navigable for light craft as far as the Rhodesian border, but it would be impossible for any heavy craft to ascend so high during the dry season. The current in the Sabi is strong in mid-stream, and continually changing with the varying depths of the channels and the rise or fall of the flood. But, provided there were sufficient depth, small steamers could always make headway against it. There is always a strong breeze blowing up-stream during the daytime, quite sufficient for sailing purposes. On the banks is an ample supply of excellent fuel for steamers, and, despite the general steepness of the banks, there are numerous good landing-places."

New Port in Cape Colony.—It seems probable that the fine harbour of Saldanha bay will before long be utilized. Application, it is stated, is to be made to Parliament for powers to construct docks and build a railway to connect the port with the existing Government line. This will be 72 miles in length, and will pass

through Hopefield and Omreesburg. The chief drawback to Saldanha bay has hitherto been the lack of water, and this it is now proposed to bring from the Berg river, 40 miles distant. It is not expected that the port will compete with Cape Town, but it is hoped that the large anchorage and good shelter available will attract shipping, especially in the case of goods intended for up-country. The harbour is completely landlocked, a natural breakwater rendering the bay always smooth. It should be remembered that this is not the Saldanha bay of the old navigators, which was the modern Table bay.

Northern Nigeria.—Some meteorological statistics of interest are given in Sir F. D. Lugard's lately issued report on Northern Nigeria. In the operations against the Emir of Yola the advance upon his capital had to be deferred until September, as that month is the only season when the Benue is navigable as far as Yola, the extreme eastern limit of the British territory. The rise and fall of the Niger has been recorded with more or less completeness ever since 1898, and the figures last given are as follows: In June the total rise was 3 inches; in July, 34½ inches; and in August, 26 inches. No record was kept in September, but at the end of October there had been a total fall of 23 inches, while in the succeeding month there was a further fall of 28 inches, and in December of 1 inch. At Lokoja and Jebba—both on the Niger—the dry season is in the winter, and during December, January, February, and March, no rain fell at the latter place, and none during the first three of these months at Jebba. The year's rainfall at Lokoja was 60 inches, and at Jebba 52 inches. The mean temperature at the two places are 81° and 82°·5 Fahr. respectively. All the stations in the territory are in future to be furnished with proper meteorological instruments.

The Muidir Plateau, Algerian Sahara.—The region south-east of Insalah consists of a rugged plateau, one of the elevated massifs which separate the oases of the Algerian Sahara from the Tuareg countries to the south. Few details have hitherto been known respecting its geographical features, but some additions to our knowledge have lately been made through the work of the French officers stationed at Insalah. The Muidir was crossed by Lieut. Cottenest during his expedition against the Hoggar Tuareg early last year, but this being a military one, passing through hostile territory, few opportunities can have offered themselves for survey work, while Lieut. Cottenest's notes were subsequently lost during the fight with the Tuareg. A short time after this officer's passage, a reconnaissance of the Muidir was carried out by Colonel Laperrine, accompanied by Lieuts. Rousseau and Réquin, the latter of whom has given an account of the march in the *Renseignements Coloniaux*, No. 8, appended to the *Bulletin de l'Afrique Française* for December, 1902. It is accompanied by a map prepared by Lieut. Rousseau. According to Lieut. Réquin, the broad physical features of this rugged region are most difficult to grasp. On the north the plateau is bordered by a complex and broken series of ridges, and on the west by a vertical escarpment of nearly constant height, but the interior forms a veritable chaos. The two most striking natural features are, on the one hand, the numerous deep clefts, traversed by *weds* flowing between perpendicular walls 600 to 1000 feet high, and on the other, the rocky crests or ridges which run over the surface, and are sometimes broken up into strange accumulations of rocks, having all the appearance of ruins. The *weds*, however, open out into green valleys, which afford good pasturage, the Muidir being more favoured by nature than Tidikelt, for it has a regular rainfall and abundance of wood, in addition to its pastures. It was formerly inhabited, but seems to have been deserted as a consequence of the French occupation of Insalah.

AMERICA.

Messrs. Powell, Quinton, and Foster's Ascent of the Souffrière.—The ascent made by these gentlemen on October 28, 1902, was briefly referred to in the last number of the *Journal*, since the issue of which Mr. Quinton has sent us a cutting from a local newspaper giving some additional details. The ascent was begun from the coast at Wallibou, the first part being exceedingly difficult, owing to the formation of several new cliffs and ravines. Afterwards, apart from the extreme narrowness of the knife-ridges, the way was easier. On arrival at the summit, it was found that the old crater was active, discharging volumes of steam, and throwing up cones of ashes from a fissure close under the southern wall. The *ejecta*, which were heaped up round the inner walls to a height of several hundred feet, were almost red hot, and were smoking profusely, while jets of steam were issuing from a fissure within 4 yards of the visitors' standpoint. Messrs. Powell and Foster went down on the southern side to a distance of about 120 yards, beyond which the walls were precipitous, and a boiling cauldron of muddy water could be clearly seen in the centre. The best view was, however, obtained from the western rim. The cloud of steam and ashes from the fissure under the southern wall was blown westward, giving the appearance of having come from the new crater, though there were really no signs that this had lately been active. The saddle between the two craters was intact. An attempt to cross to windward having failed, owing to the steepness of the southern rim and the heat of the ashes, the descent was commenced, and proved much harder than the ascent. For a considerable distance down the sides the mountain is covered with portions of the rock and coarse gravel thrown out.

Northern Frontier of Bolivia.—A map published by the Officina Nacional de Immigración, Estadistica, etc., at La Paz, shows the various frontier-lines which have been the subject of diplomatic negotiations. The furthest north is the Ballivian-Cruls line, by which the frontier has been definitely fixed with Brazil. It extends from the Madeira falls north-westwards to the Yaquirana, the source stream of the Yavary, in lat. 7° 6′ S. and long. 73° 47′ W. Towards Peru Bolivia claims a line running from the Inambari, between the Chandless and Manu, and along the Amazons watershed to the Yaquirana, while the Peruvians claim the country as far south as the Beni. This would deprive Bolivia not only of the Territorio de Colonias, but of almost all the province of Caupolican, and would add some 190,000 square miles to Peru.

AUSTRALASIA.

Journey across Australia.—Mr. R. T. Maurice, whose journey into the interior of Australia from Fowler's bay on the south coast was referred to in the *Journal* for June, 1902 (p. 760), last year carried out a more extended expedition, again in company with Mr. W. R. Murray (as surveyor), which led across the whole breadth of the continent to the north coast. A short narrative of the journey appeared in the *Adelaide Observer* of November 29, 1902. The party, which had with it fourteen camels, left Fowler's bay in April, 1902, and took about seven months to complete the journey, crossing the tracks of Giles, Tietkins, Gosse, Warburton, and other explorers, whose routes had led mainly in an east-and-west direction. Various permanent waters were discovered, and as the year was exceptionally dry, there can be no doubt that the supply at these places is really perennial. Geological, ethnological, and zoological collections were made. At an early stage of the journey the Afghan camel-driver deserted, and some time was spent in a vain endeavour to track him down. From Oolarinna, a water which

had been visited on the former journey, the party struck across for the Everard range, where sufficient water was with difficulty obtained, though it was in the vicinity of the range that the first and only rain experienced fell. The country is described as very grand and rugged. The neighbourhood of the Musgrave range was found in a worse condition than had ever been known before, and of the rabbits which once swarmed, only one or two were seen. After crossing with some difficulty a ragged precipitous range beyond the Musgrave, and taking copies of some remarkable aboriginal drawings, the expedition reached Opparinna, where the running spring was found to have not diminished much since the previous year. By removing the outer wood of a marked tree in the vicinity, the inscription "J. Lamb" was distinctly made out, though by whom and when the name was inscribed is unknown. Some auriferous outcrops were noticed, extending towards Petermann range, and near Ayers rock (so named by Gosse) copies of some fine aboriginal drawings were obtained. At Tietkins' hole, near Mount Olga, photographs were taken of the marked tree, the inscription on which was as legible as when first cut thirteen years before. A water was found a little to the south of Lake Amadeus, and by it were traces of a very ancient camp. The softness of the ground making it unsafe to cross Lake Amadeus where first struck, the party turned aside to its western end. Near Giles' creek a splendid water-hole, thought to contain perhaps a million gallons, was found, and named Thomas' reservoir. Mounts Lyell, Brown, and Russell, seen but not visited by Tietkins, were found dry and barren. At Eva Springs, on Warburton's track, relics of that explorer's stay were found, and in the range near, two beautiful springs were discovered. Beyond Mount Singleton an extraordinary cave was found, and after a stretch of the poorest desert country Dr. Davidson's track was reached. Here a number of camels were poisoned by eating *Gastrolobium*, and it was considered advisable to make for civilization at Sturt's creek, whence the rest of the journey to Wyndham on Cambridge gulf was effected by frequented tracks.

Australian Transcontinental Railway.—An official notice in the *South Australian Government Gazette* calls for tenders for the construction and working of a line of railway from north to south across the Australian continent. In the northern territory the railway has not as yet penetrated very far into the desert, the distance from Port Darwin to Pine Creek (the terminus) being not much more than 150 miles; but in the south the line has almost reached the 27th parallel of south latitude, north-west of Lake Eyre, where Oodnadatta has for some years been the terminus. It is now proposed to connect these two points, and the scheme is to be carried out on the land-grant system. The land to be granted is not to exceed 75,000 acres for each mile of railway, and is to be selected in alternate blocks on either side of the line. The grant is in fee simple, with all gold and minerals thereon and thereunder. The line, which is to have a gauge of 3 feet 6 inches, will be under 1200 miles in length.

POLAR REGIONS.

Dr. Charcot's Arctic Expedition.—A scientific expedition to the Arctic regions is being organized by Dr. Jean Charcot, with the support of the French Academy of Sciences, the Natural History Museum, and the Ministry of Public Instruction. M. Charcot, who last year made a voyage to Jan Mayen, is impressed with the necessity for the scientific study of the regions already known, to serve as a point of departure for further explorations in the neighbourhood of the pole, and will take with him assistants, who will make observations in the field of geology, meteorology, oceanography, biology, and other branches of science. A three-masted schooner of 400 tons is being built at St. Malo for the purposes of the

expedition, which will, it is hoped, sail in May on a six months' cruise. It is proposed to visit Jan Mayen, Spitsbergen, Franz Josef Land, and the north-west part of Novaya Zemlya.

The Danish Expedition to West Greenland.—The Danish Expedition which went out in 1902 for the purpose of researches into the folk-lore, etc., of the native inhabitants of Greenland (*Journal*, vol. xix. p. 641), was in September last at the Holstenborg colony, on the west coast, whence the leader, Mr. Mylius Erichsen, has sent to the *Standard* some account of the experiences of his party during the summer months. A large part of the narrative consists in a description of the free, open-air life which during this time the explorers had shared with the Eskimo—sailing, canoeing, or shooting along the mountainous fiord-pierced coasts of West Greenland. Some account is, however, given of two attempts to ascend the "inland-ice," which are of some geographical interest. The first was made from the inmost end of the Godthaab fiord, into which the Ujaragssuit glacier debouches. An unavailing attempt to ascend this glacier had been made by Nansen during the winter following his crossing of Greenland; nor was Mr. Erichsen's party more successful, the attempt being frustrated on two successive days by the softness of the clay banks of the river which emerges from the glacier, the impassable nature of this stream, and—when a *détour* of eighteen hours had been made over the mountain-side—by the perpendicular wall by which the latter fell towards the glacier. On the second day a good-sized ruin dating from the period of the Norsemen was discovered and sketched. Subsequently a more successful attempt to reach the ice was made from Sukkertoppen, the route chosen leading thence up the Sermilinguak fiord, into which an arm of the inland ice makes its exit. Mr. Erichsen (who took with him one of the sledges used by Nansen in 1888) was accompanied by Count Moltke and by a young Greenland ecclesiastic, Jörgen Brönlund, and by one of the Greenlanders who had formed his crew to the head of the fiord. As the ascent progressed the ice became more and more rough, the whole surface being furrowed by crevasses separated by narrow ridges and pinnacles. With great difficulty the leader reached the summit of a "nunatak" over 3000 feet above the sea, whence a view was obtained which enabled him to correct existing maps in certain particulars. It was found that the 50–70 miles of ice between the South Isortok fiord and the Evigheds fiord is separated from the true inland ice to the east by a lower country of lakes and rivers that receive the waters of the inland ice. Subsequently, on a glacier walk from the head of the Evigheds fiord, Mr. Erichsen found that the body of ice between that fiord and the Söndre Ström fiord is separated from the inland ice proper by two rows of nunataks forming virtually two consecutive mountain ranges, this being again not shown on existing maps. At the time of writing the Expedition was about to start northward for Egedesminde (69° N.), as a stage in the further advance towards winter quarters on Melville bay.

Expeditions to Greenland.—The expedition sent out to East Greenland during the summer of 1901 under the auspices of the Danish Greenland Committee, with the support of the Carlsberg fund, which had as leader the botanist C. Kruuse (accompanied by his wife), has, we learn from *Petermanns Mitteilungen* (1902, p. 267), safely returned after spending a year in that inhospitable region. The headquarters were fixed at Angmagsalik, where biological investigations were carried out during the winter. This was long and severe, though calm, and the ice remained fast on the coast from the middle of December to the middle of June. After the latter date a survey was made, by means of a motor boat, of the two large fiords of Angmagsalik and Sermilik. The flora of this region was found to consist of 110 to 112 species of phanerogams and vascular cryptogams, besides lower

forms, and the results of the expedition include zoological collections, and biological and ethnographical studies. An expedition to the opposite side of Greenland was carried out in the summer of 1902, under the same auspices, by Dr. Engell, who executed surveys and made studies of glacier movement, plant life, etc., in the neighbourhood of the Tasiusak fiord, near Jacobshavn, as well as in some hitherto unknown districts further south.

Geodetic Work in Spitsbergen.—The result of the four years' work (1899–1902) in Spitsbergen is the measurement of a meridional arc, 4° 11′ long, between the Keilhaus mountain in the south and the Little Table island in the north. The Russian party undertook the southern part, from lat. 76° 38′ to 79° 4′, and the Swedes the northern, up to lat. 80° 49′. Both parties measured a base with Jäderin's apparatus, in which the bars are of nickel steel, the Swedish base being nearly 10,960 yards long, and the Russian about 6799. Latitudes have been determined at the points where angular measurements were taken, and at six others—twenty-nine points in all, or about one for every 9 minutes of arc, so that an unusually exact study of the surface form will be possible. Twenty-three azimuths have been taken, which will serve to detect local disturbances in azimuth, and the influence of the attraction of the adjacent lands on astronomical observations has been ascertained. Gravity observations by means of the pendulum have been made at several points. Besides the work of triangulation, the meteorology, geology, and botany of the districts visited have received attention. It has been agreed that the observations shall be published in detail, and that the Russian and Swedish commissions shall work out separately their respective portions of the triangulation series, but that in the reduction of final results, involving a comparison of the astronomical and geodetic results, the commissions shall co-operate. A map of the region covered by the triangulation will be published on the scale of 1 : 200,000, and special maps of the triangular points on a larger scale. A conical projection will be used, the tangent plane touching the Earth's surface at 78° 30′ N. lat. The general map will consist of five sheets, of which three will be compiled by the Russians. The results of the expedition will be published in French in a series of memoirs, and will be ready for printing within the year. The sections included in the first part of the work will deal with the geodetic and astronomical results, gravity and tidal observations, etc.; while magnetism, meteorology, geology, botany, etc., will furnish the subjects for the memoirs in the latter part. *Ymer*, No. 4, 1902.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Figure of the Earth.—In a paper communicated to the Geological Society at its meeting on January 21, Prof. Sollas discussed the figure of the Earth from a quite new point of view, with the remarkable result that he obtains by empirical methods a figure agreeing with the mathematical conclusions of Mr. Jeans (*Geographical Journal*, February, 1903, p. 191), *i.e.* a "pear-like shape." In the note referred to we pointed out that, although Mr. Jeans's general conclusions would not be affected, his description of regional distributions was likely to be criticized, and we accordingly find that Prof. Sollas places the "stem" of his pear in the middle of Africa, while the "broad end" is covered by the Pacific. He points out the almost precise correspondence of great terrestrial features with a circular form. The Aleutian curve has its centre in lat. 6° N., long. 177° W., that of the East Indies about 15° N. and 118° E., and round the latter centre are several concentric curves. The northern part of South America, the Alpine-Himalayan chain, the western shore of North America, and a portion of Australia, may be similarly reduced to geometric form. A great circle swept through the

centres of the East Indian and Aleutian arcs runs symmetrically through the bordering seas of Asia as far as Alaska, borders the inland lakes of America, passes the Californian centre, extends through the middle of the Caribbean sea, runs parallel with the coast of the Antarctic continent, and returns to the East Indian centre without touching Australia. This course is in remarkable correspondence with the general trend of the great zone of Pacific weakness. If the pole of this circle in the Libyan desert is placed towards an observer in a globe, the African continent appears as a great dome surrounded by seas and separated from the Pacific by an irregular belt of land. A second great circle defined by Lake Baikal, and with its centre at "the morphological centre of Asia" of Suess, and passing through the East Indian centre, may be regarded as the direction-circle for the Eurasian folding. These two circles intersect at an angle of 39°, and on bisecting this angle a mean directive circle is found with its pole near the sources of the White Nile 6° north of the Equator. The axis of terrestrial symmetry through this pole passes through the middle of Africa and of the Pacific ocean. The smallest circle which will circumscribe Africa has its centre near this pole, and within it the symmetry of the fractured African dome is observable. Outside this comes a belt of seas, and outside that again the Pacific belt of continents, the Antarctic, South America, North America, Asia, and Australia. A significant feature connected with this way of looking at the question is the greatly increased importance of *fracture*, or "faulting," relatively to *folding* or thrusting, in the transition from the piriform to the spherical shape.

Star-shaped Maps of the World.—Various forms of the star-shaped representation of the globe have been suggested since the idea of such representation was first mooted in 1865 by Dr. Jäger of Vienna. The one most commonly employed, and which was first adopted by Berghaus in 1879, is that in which the star has five branches, which results in the separation of Australia into two portions contained within two separate branches. The equidistant projection is usually employed, and the outlines of Africa and South America are much distorted. In the *Bulletin de Géographie Historique et Descriptive* for 1902 (part. ii.), Lieut. Berthon suggests a form that has not been made use of before, the number of branches being reduced to four, while the stereographic projection is used instead of the equidistant. The branches are so constructed that corresponding parallels are at equal distances from the equator in both hemispheres, while the distances between the meridians on corresponding parallels are also equal. The outer meridians of the several branches are thus considerably curved outwards, and the obliquity of the meridians with the parallels is reduced. The shapes and relative positions of the continents are certainly well shown by this means, but the enormous exaggeration of the size of the equatorial parts of the globe is a disadvantage, South America appearing very much larger than North America, and Africa than Asia; so that it is doubtful whether on the whole the new method is a great improvement on the old. The slight modification of the usual five-branched star employed in Dr. Mill's 'International Geography' possesses some advantages over both; the use of eight branches, alternately wider and narrower, permitting the three great southern land-masses, as well as the centres of the three great oceans, to be each coincident with a ray of the star.

The Supply of Chloride of Sodium by Rivers to the Sea.—Since the question of the possible calculation of the age of the Earth by a consideration of the amount of sodium annually supplied by rivers to the ocean was brought forward some three years ago by Prof. Joly, the subject has engaged the attention, on the continent, of Prof. Eugène Dubois, whose latest communication on it appears in vol. iv. (1902) of the *Proceedings* of the Section of Sciences of the

Royal Academy of Sciences at Amsterdam. Prof. Joly's estimate was based on Sir John Murray's estimate, made some years ago, of the average composition of river-water. This estimate, which depended on analyses of the water of nineteen rivers only, was not regarded by its author as more than tentative, and Prof. Dubois shows that much more extensive observations are necessary to yield a trustworthy result. He has with much care brought together the results of analyses of seventy-five different rivers or portions of rivers (many of them series extending over a considerable time), so far as concerns the proportions of sodium and chlorine contained in their water. The figures show a very great variation between the different rivers, and consequently a striking deviation of the actual values from Sir John Murray's average. Generally, the quantity of sodium is found to be much less than the latter's estimate; and Prof. Dubois shows that it is still further diminished when the quantities derived from the pollution of the rivers by human agency, and the amount supplied by rain, are taken into account. In the case of the Meuse, he calculates that not more than 1·5 parts per million parts of water is due to chemical denudation, out of an observed total of 3·44 parts, whereas the average derived from Sir John Murray's figures is 5·88 parts. Further, it is to be noticed that in almost all river-water there is a decided deficit of chlorine as compared with the quantity that could be combined with the sodium, so that, as all the sodium in sea-water is combined with chlorine, some other supply of the latter than is brought down by rivers must be available. There is no difficulty in accounting for this supply when we consider the amount of hydrochloric acid gas discharged into the atmosphere by volcanic agencies, and the fact that three times as much rain falls on the ocean as on land. Prof. Dubois concludes by showing that, as the amount of sodium really attributable to chemical denudation appears to be only a quarter of that assumed by Prof. Joly, a period of four hundred million years would be necessary to account for the existing amount in the ocean if this were entirely due to the agencies supposed. Such a result leads to a distrust of the applicability of existing data to the problem, and lends weight to the opinion to which other geological facts had led—that the greater part of the chloride of sodium in the ocean must have been produced by a far more rapid process than that of existing chemical denudation.

The Origin of "Karren."—M. E. A. Martel has a note in the *Comptes Rendus* of the Paris Academy of Sciences (December 15, 1902) on the origin of the surface formation met with most commonly in limestone districts, which is usually known by the German term *Karren*, or the French *Lapiaz*. The formation of the vertical clefts separating the separate blocks is usually ascribed to the chemical action of rain or snow on the rocks, but M. Martel holds that an important part is also played by the mechanical action of running water. The best known examples of *Karren* occur in alpine districts, at a considerable elevation, but the writer gives a number of instances in which the formation is met with in valleys or plains of low elevation, sometimes in the actual beds of rivers (as, *e.g.*, at the falls of the Sautadet or at the first cataract of the Nile), or even in the sea (as at Killsee in Ireland). Even where the *Karren* occur at high elevations, M. Martel holds that in many cases they represent portions of old river-valleys which have remained perched in the air, while the rest of them has been removed either by tectonic movements or subsequent denudations. He also finds a constant relation to exist between the *karren* and the swallow-holes or abysses in which the surface waters are engulfed in limestone regions, and which have resulted in substituting a subterranean for a sub-aërial circulation of the water. This invariable relation, to which attention, M. Martel says, does not seem to have been previously called, is, in his opinion, a strong argument in favour of the idea that in a large number

of cases the *Karren* have been *originally* formed by the action of running water, although at the present day chemical action, the effects of which are far more feeble, may have taken its place.

OBITUARY.

Sir J. Lintorn Simmons.

By the death of Field-Marshal Sir John Lintorn Arabin Simmons, G.C.B., G.C.M.G., the little band of Fellows who can claim that their connection with our Society dates back more than half a century, loses one of the most distinguished of its members. In his younger days the duties of Sir John Simmons carried him far from the mother country, and though never in any sense an explorer, he was fond of travelling, and manifested his interest in geographical discovery by joining the Society in 1848. Born in 1821, Simmons entered the Royal Engineers in 1837, and for some time served in Canada. Subsequently he held responsible posts in connection with the early development of the railway system in this country. The Crimean war opened up to him a new field in which to gain distinction. Being in Constantinople in 1853, on leave of absence, he was employed on several missions connected with the negotiations which preceded the war, and the following year was appointed her Majesty's commissioner with the Ottoman army. During the war he saw considerable service in various parts of the Nearer East, and in 1857 was the British representative on the commission which laid down the boundary between Asia Minor and Transcaucasia. For two years after this he acted as Consul-General at Warsaw, but in 1860 again took up work in this country, and during the next twenty years filled various important posts, being director of the School of Military Engineering at Chatham, 1865–68; governor of the Royal Military Academy at Woolwich, 1870–75; and Inspector-General of Fortifications, 1875–80. He was also attached to the British Embassy which attended the Berlin Congress of 1878, and took part in the Berlin Conference of 1880, which assembled to discuss the Greek frontier question. In 1884 he was appointed Governor of Malta, but, reaching the age-limit four years later, had to retire. Sir John Simmons received the Knight Commandership of the Bath in 1869, and became a Knight of the Grand Cross of that Order nine years later; he was made a G.C.M.G. in 1887. After his retirement, Sir John acted as Envoy Extraordinary and Minister Plenipotentiary to the Pope in 1889, and the following year was given rank as a Field-Marshal. He died on February 14, two days after his eighty-second birthday.

John Hall Gladstone, PhD., D.Sc., F.R.S.

Dr. John Hall Gladstone, who died in October, 1902, at the age of seventy-five years, was one of our older members, having joined the Society in 1863, or nearly forty years ago. Although best known for his work in connection with chemistry, Dr. Gladstone was a man of broad sympathies and attainments, and in particular was deeply interested in all questions related with the improvement in educational methods, being himself a member of the School Board for London for over twenty years. The efforts of our Society to improve the status of geography as a branch of study in this country met with his warm approval, and he took part in the discussions which took place at the meetings in connection with the Society's

Educational Exhibition in 1885. Dr. Gladstone, who was educated at University College, London, and at Giessen University, was Fullerian Professor of Chemistry at the Royal Institution from 1874 to 1877, President of the Physical Society from 1874 to 1876, and of the Chemical Society from 1877 to 1879, and was the author of various scientific papers, chiefly on chemical subjects.

Dr. James Stevenson.

The death occurred on January 28 of Mr. James Stevenson, LL.D. Born in 1822, Mr. Stevenson passed through Glasgow University, where he displayed mathematical abilities of a very high order. His sympathies, however, were not confined to that branch of scholarship, and in later years he assisted the University substantially in the promotion of various studies. His generous and instructed interest in the progress of education was recognized by the University a short time ago, when his doctor's degree was conferred upon him. In the geographical world Mr. Stevenson was best known for his connection with British Central Africa, where his name will be preserved so long as the Stevenson road endures and bears that designation. He was one of the many caught into the current of the great outburst of missionary zeal, and of enthusiasm for the work of opening up the Dark Continent by exploration, which followed the death of Dr. Livingstone. He joined the Royal Geographical Society in 1877, and was closely associated with the African Lakes Company, founded a year later, of which he was Chairman at the time of his death. Early in the eighties, Mr. Stevenson vigorously pressed a scheme for the construction of a road between Lakes Nyasa and Tanganyika. He himself subscribed some thousands of pounds to enable the necessary surveys to be carried out. The road was never properly laid down, but a path was cleared through a considerable stretch of difficult country, and a route opened up which not only will long preserve Mr. Stevenson's name on our maps, but has not been without importance in the diplomatic negotiations that accompanied the partition of the continent.

CORRESPONDENCE.

Captain Benjamin Wood's Expedition of 1596.

In my Introduction to 'The Travels of Pedro Teixeira' (Hakluyt Society, 1902), I have given, on pp. xliii.–lviii., some details, mostly from Portuguese sources, of the voyage and ultimate fate of the three ships—*Bear*, *Bear's Whelp*, and *Benjamin*—of Captain Benjamin Wood's Expedition, which left England for the Far East in the latter part of 1596, and respecting which there has been much confusion and misstatement owing to a blunder of Purchas's. I have there shown that one of the ships was lost somewhere off the south coast of Africa; and that the other two ships, after acts of piracy on the Malabar coast, encountered, in the Malacca strait, a Portuguese fleet, with which they carried on a running fight for eight days, at the end of which time, owing to the blowing up of the gunpowder on board the "admiral," the two English ships retired to Old Kedah to repair and refresh. Owing to their diminished numbers, however, the Englishmen abandoned the smaller vessel at this port, and set sail for home in the "admiral," which shortly afterwards foundered in a storm off Martaban.

Although Couto, who supplies us with this information, erroneously calls these ships "Hollander," and records a precisely similar fate as having befallen the Dutch ships *Leeuw* and *Leeuwin* (on one of which John Davis was pilot) in 1599, I

could find no reason to doubt the accuracy of his account of the ending of Wood's expedition. Now, through the kindness of Mr. William Foster, B.A., of the India Office, I am able to substantiate the general accuracy of Couto's narrative, and to carry the story a step further. Mr. Foster has drawn my attention to a passage in the English translation, by John Davies, of Mandelslo's Travels (London, 1662), pp. 246–247, which occurs in connection with a description of Mauritius, and reads as follows:—

"When the Dutch came thither in September 1601. they found there a French souldier, who had left his Countrie some three years before, with three English ships, which were the first in those parts that attempted sailing into the Indies upon the accompt of Piracy. Of these three ships one was cast away neer the Cape of Good hope, and sickness having consumed most of the men, they that remained set fire on the second, in regard for want of men, they were not able to govern it. The third was wrack'd upon the Coasts of the Indies, where all the men were lost, seven only excepted, to wit, four English men, two Negroes, and a French souldier, who attempted to return with some booty, which they disposed into a Cannow, wherein they set to Sea, and made a shift to get to Maurice-Island. The two Negroes had a design there to rid themselves of their Camerades, but being discovered they cast themselves into the Sea, and were drowned. The four English men would prosecute their Voyage, but the French souldier chose rather to continue in the Isle, then double the Cape, and expose himself to the mercy of the Sea, in so small a Vessel. Accordingly, of the English men, there was no more news heard. The French man had been 20 monoths in the Island, when the Dutch came thither. He was stark naked, in regard that having been in a burning Feaver, which heightened into a degree of madness, he had torn his cloaths; so that having not had any thing about him ever since his sickness, nor fed on any thing but the raw Tortoyses he took, they were not a little surpriz'd at the sight of him, and conceived it would be no easie matter to restore him to his senses, though he behaved himself well enough otherwise, and was in very good health."

As Mr. Foster points out, the above story does not occur in the original (German) edition of Mandelslo's Travels (1665), but is an interpolation by Abraham van Wicquefort, who translated the Olearius-Mandelslo Travels into French and published his translation in 1659. There is no copy of this first French edition in the British Museum Library; but in the second edition, published in 1666, the passage occurs on pp. 523–524 of tom. ii. From a comparison of this with Davies's version, I find that the latter is a pretty faithful rendering of the French. Now, whence did Wicquefort obtain the details given above? Only one source, as far as I know was available to him, viz. the diary of the voyage of the fleet of five Dutch ships that sailed from the Texel for the East on April 23, 1601, under the command of Wolphert Harmanszoon. This diary was first printed in 1645, forming part of the collection of voyages entitled 'Begin ende Voortgangh vande Vereenighde Nederlantsche Geoctroyeerde Oost-Indische Compagnie.' On p. 5 of this journal the diarist states that on August 20, 1601, the ships were in a calm in 33° 11′ S. lat. There is then a strange (and regrettable) breach of continuity in the diary as printed; for the next entry reads:—*

"On 13 September [1601] the yacht named *Duyfken* came back † out of the harbour in Mauritius bringing with it some *koques*,‡ and a Frenchman named

* I have translated as literally as possible, and have retained the punctuation of the original.

† Owing to the gap in the diary, we have no record of the dispatch of the yacht, or of the date on which it left the fleet.

‡ Coconuts.

Françoys, who some years before had sailed from England with a captain *in compagnie* of 2 ships, with a yacht, and, so the aforesaid Frenchman relates, after that they had captured some ships and junks on the coast of Melinde, were compelled (owing to the great loss of men, and deaths' occurring daily, so that the aforesaid ships were as no more than one, for near the Cape of *Bonne Esperance* they lost their yacht, and owing to the loss of men they burnt their vice-admiral, on account of the continuance of the sickness) to strand the aforesaid ship (which was the third) near by Malaca on the island of Pulo Bontan,* where the aforesaid ship remained, and all the men died except seven, to wit, four Englishmen, and this Frenchman, with two blacks; which 7 persons bestowed themselves in an Indian junk with some booty, in order to cross over to England therewith, but on getting to sea, the two blacks, so he says, plotted some treachery, but their attempt failed, which seeing, out of desperation they leapt overboard, drowning themselves, so that the 4 Englishmen and this Frenchman arrived in the aforesaid junk at this roadstead where we lay; where they lay eight days, at which time, so it appears, they had a disagreement, because the Frenchman wished that they should remain there, hoping for the mercy of God, so that in time they might make their junk stronger and larger, but the Englishmen would not stay longer there; so the four of them put to sea in the aforesaid junk in order to get to England; so that this poor man had remained alone on the island for a period of 18 or 20 months, of which time he had been eight months without fire, going about all that time naked, sustaining himself with *palmites* † and raw turtle ‡ flesh, yet he was as corpulent [*sic!*] and robust as any of the fleet, both in running and otherwise, but was very muddle-headed when he was asked much, which is not to be wondered at, when one thinks, what manifold fancies such a man in so long a time might have, as also the heat of the sun, in which he had gone about always naked, because, so he says, in a severe illness that he had had, he had torn all the clothes from his body, may the Almighty God restore to him his former health, and preserve us all from such a calamity Amen."

Whether the diarist's pious aspiration for the restoration to mental vigour of the unfortunate Frenchman was fulfilled, I do not know, as no further mention is made of him. But his affliction is a misfortune to us, for it vitiates to some extent the accuracy of his story. However, taking it as it stands, let us see how it compares with Couto's account; for that it refers to Wood's expedition there cannot be the least doubt.

According to the Frenchman § the fleet consisted of two ships and a yacht, and had sailed from England "some ‖ years before." This can apply only to Captain Wood's fleet, consisting of the *Bear* (of 180, 200, or 300 tons ¶), the *Bear's Whelp* (of 80 or 140 tons ¶), and the *Benjamin* (probably the yacht, tonnage unknown), which sailed, as I have said, in 1596.

The yacht, the Frenchman said, was lost off the Cape of Good Hope.** This

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* A misprint for *Bouton*, probably.

† Portuguese *palmito* = the palm "cabbage."

‡ Or tortoise

§ Whom Wicquefort, with no apparent authority, designates a "soldier."

‖ Wicquefort, it will be noticed, has quite unwarrantably and erroneously inserted "three." He adds, that these were "the first [English ships] in those parts that attempted sailing into the Indies upon the accompt of Piracy," which is also erroneous, as the Raymond-Lancaster expedition had preceded this one by more than five years.

¶ See 'The Voyage of Robert Dudley' (Hakluyt Soc.), Preface, p. xxxi., regarding these varying estimates.

** As I surmised (see p. xlv of my Introduction referred to above)

accounts for the fact that when we first hear of the ships from Portuguese sources only two are mentioned.

So far, all is plain sailing; but now the two accounts vary in detail. The Frenchman is silent as regards the calling of the two ships at Quitangonha for water, but, on the other hand, informs us that they "captured some ships and junks on the coast of Melinde," a fact not mentioned by the Portuguese writers. It is possible, however, that the reference is really to the capture of Portuguese vessels off the Malabar coast, recorded by the Goa Chamber and by Couto, but not by the Frenchman. These discrepancies may fairly, I think, be charged to the latter's "muddle-headedness."

Far more unaccountable, however, is the utter silence of the Frenchman in regard to the engagement with the Portuguese fleet in the Strait of Malacca, of which Couto gives us such a graphic account. I can only once more attribute this silence to mental aberration.

The loss of men on the English ships Couto attributes entirely to the effect of the Portuguese artillery, but according to the Frenchman (and with much greater likelihood), it was due to sickness.*

According to the Frenchman, again, the English, on account of their diminished numbers, burnt their "vice-admiral;" † but where, he does not say. Couto tells us that the Englishmen "left in that port [Kedah] the ship of lesser burden." We may therefore take these two statements as agreeing.

Couto also states that after the Englishmen had abandoned their smaller ship, "in the other, which was the admiral, they embarked what they had, and went off in great haste, so much so, that they left on shore several wounded men, because the natives wished to attack them for various wrongs that they had done to them, and shaped their course for Bengalla; and in the latitude of Martavão on the coast of Pegu they were lost in that *macareo*." On the other hand, the Frenchman's version is, that the English were compelled, owing to their loss of men, to strand the remaining ship, the "admiral," ‡ on Pulo Butung,§ which island is not "near by Malacca," as the diarist states,‖ but is on the west coast of the Malay peninsula, not far from Kedah. Now, it is probable that Couto's statement, that the "admiral" ¶ went down in a storm off the coast of Pegu, is based on mere surmise, and the Frenchman's account may be quite correct; there is, at any rate, nothing to justify our rejecting it.

The rest of the Frenchman's story we are obliged to take as we find it, having no other testimony to substantiate it or to contradict it. If it be true that when rescued by the *Duyfken* he had been "alone on the island for a period of 18 or 20 months," he and his companions must have arrived there early in the year 1600, and must therefore have set out from Pulo Butung towards the end of 1599. Now, according to Couto, the fight between the English ships and the Portuguese fleet took place in January, 1598; so that the survivors of this unfortunate expedition

* Compare the terrible mortality that took place on board the Raymond-Lancaster ships.

† The *Bear's Whelp*, probably.

‡ The *Bear*, doubtless.

§ While the English ships were at Kedah, Couto states, the Portuguese captain of Malacca sent a couple of vessels to look for them, which went as far as Pulo Butung, but did not find them

‖ The Wicquefort-Davies version has it that the third ship "was wrack'd upon the Coasts of the Indies [!], where all the men were lost [*sic*], seven only excepted."

¶ Compare what I have said above as to Couto's attributing the same ending to two Dutch ships.

must have spent nearly two years at Kedah and Pulo Butung. Although this is not beyond the bounds of possibility, it may well be that the Frenchman's memory had played him false, and that his sojourn on the island had been longer than is stated. That the junk with the four Englishmen and the "booty" was lost at sea, or cast away on some wild coast of Africa, is evident; otherwise we should have some record of their foolhardy voyage.

Owing to the above-mentioned lacuna in the Dutch diary, and the general vagueness of the bearings recorded, it seems impossible to identify the "harbour" in Mauritius where the unfortunate Frenchman was rescued from a living death; and as the original manuscript of the diary no longer exists,* the omission from the printed edition of 1645 cannot now be supplied.

DONALD FERGUSON.

20, Beech House Road, Croydon,
January 21, 1903.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1902-1903.

Sixth Ordinary Meeting, January 26, 1903.—Colonel G. EARL CHURCH, Vice-President, in the Chair.

ELECTIONS.—*Captain W. E. Bailey, East Yorks Regt.; William Singer Barclay; Sidney Barton; Harlan P. Beach; George Alexander McLean Buckley; Cuthbert John Burgoyne; George Bush, M.I.C.E., F.S.A.; Gillmore T. Carter; Bertram Chaplin; Captain James K. Cochrane, Leinster Regt. W.A.F.F.; David Delbanco; William Francis Farrer; Colonel George Malcolm Fox; William Fry; James William Gorson; Willie Henry Gibbings; Colonel Robert Edmund Golightly; Robert Joseph Hardie; Captain Ralph Henvey, R.F.A.; Major E. H. Hills, R.E., C.M.G.; Charles Kennedy Hoghton; Major William Campbell Hyslop, R.F.A.; Henry H. Joseph; John H. Leveson-Gower, Grenadier Guards; James Compton Merryweather; Lieut. Richard John Noal, R.N.R.; Captain Charles William Orr, R.A.; Captain R. C. R. Owen, Oxford Light Infantry; Daniel Thomas Phillips; Joseph Purvis; Ernest John Reid; James Christie Reid; Robert Lyons Scott; Rev. Henry John Shirley; William Hillman Shockley; Lieut. Roderick McKenzie Skinner, R.A.M.C.; H. Cecil Sotheran; Thomas Spinks; Edmund Storie.*

The Paper read was:—

"Irrigation and Colonization in British East Africa." By R. B. Buckley, Esq., C.S.I.

Seventh Ordinary Meeting, February 9, 1903.—Sir CLEMENTS MARKHAM, K.C.B., F.R.S., President, in the Chair.

ELECTIONS:—*William Whitehorn Bakewell; John Foster Bass; Lionel Cohen; Robert Evans; Dr. Joaquin Gonzales; John Harley Harley-Mason; Right Hon. Lord Headley; Captain Thomas Nairne S. M. Howard, King's African Rifles; Lieut. Philip Howell, Queen's Own Corps of Guides; Lieut. Richard Meinertzhagen, King's African Rifles; Frederick T. Miller; Major Oswald Henry Pedley, Connaught Rangers; W. G. Richardson; S. H. Soper; W. T. Taylor, B.A.; Edward Valpy, B.A.; Sir Henry Wardlaw, Bart.; W. Ritchie Wickson.*

The Paper read was:—

"Changes in the Neapolitan Coast-line." By R. T. Günther, Esq., M.A.

* At least, no mention is made of it by Tiele in his 'Mémoire Bibliographique sur les Journaux des Navigateurs Néerlandais,' pp. 203 204

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Austria—Geodesy. ——

Publicationen für die Internationale Erdmessung. Die Astronomisch-Geodätischen Arbeiten des K. und K. Militär-Geographischen Institutes in Wien. XVIII. Band. Trigonometrische Arbeiten. 8. Die Netz-Ausgleichungen im Ostlichen Theile der Monarchie. Herausgegeben vom K. und K. Militär-Geographischen Institute. Wien, 1902. Size 12 × 9½, pp. x. and 280. *Map.*

Balkan Peninsula—Wallachia. **Martonne.**

La Valachie. Essai de Monographie Géographique. Par Emmanuel de Martonne. Paris: Armand Colin, 1902. Size 10 × 6½, pp. xv. and 388. *Map and Illustrations. Price 12 fr. Presented by the Author.* [To be reviewed.]

Denmark—Jutland. *Globus* **83** (1903): 41–48. **Hansen.**

Veränderungen auf der Karte von Jütland. Von Prof. R. Hansen.

Denmark—Meteorology. ——

Annuaire météorologique pour l'année, 1900. Publié par l'Institut météorologique Danois. Deuxième partie (pp. 98); ditto, pour l'année 1901. Première partie (pp. 140). Kjøbenhavn, 1902. Size 14 × 9½.

Europe—Area and Population. **Levasseur and Bodio.**

E. Levasseur et L. Bodio. Statistique de la Superficie et de la Population des contrées de la terre. Introduction et Première Partie (Europe). Extrait du *Bulletin de l'Institut international de statistique.* Tome xii. 2ème Livraison. Rome, 1902. Size 10 × 7, pp. viii. and 110. *Presented by M. E. Levasseur.*

Europe—Geodesy. **Börsch and Krüger.**

Veröffentlichung des Königl. Preussischen Geodätischen Institutes. N.F. No. 10. Lotabweichungen. Heft ii. Geodätische Linien südlich der Europäischen Längengradmessung in 52 Grad Breite von A. Börch und L. Krüger. Berlin: P. Stankiewicz, 1902. Size 12 × 9, pp. x. and 204. *Maps.*

France. *B.S.G. Lille* **37** (1902): 146–163, 204–214, 269–289. ——

Nos frontières, Étude de Geographie militaire. *With Maps.*

France—Auvergne. *La G., B.S.G. Paris* **6** (1902): 370–374. **Bruyant.**

Le Mont-Doré et les lacs d'Auvergne. Notes de géographie biologique et de limnologie. Par Prof. Bruyant.

France—Dauphiné. *La G., B.S.G. Paris* 6 (1902): 197–217, 289–308, 375–391. **Paquier.**
Étude sur la formation du relief dans le Diois et les Baronnies orientales. Par V. Paquier.

France—Early Cartography. *B.G. Hist. et Descriptive* (1902): 176–183. **Marcel.**
Une carte de Picardie inconnue et le Géographe Jean Jolivet. Par G. Marcel.

France—Landes. *C. Rd.* 135 (1902): 1134–1135. **Fabre.**
Sur le courant et le littoral des Landes. Note de L. A. Fabre.

France—Touraine. *B.G. Hist. et Descriptive* (1902): 270–275. **Chauvigné.**
Étude comparative des différents "Pays" de Touraine avant 1789. Par Aug. Chauvigné. *With Map.*

France—West Coast. *B.G. Hist. et Descriptive* (1902): 149–154. **Duffart.**
Nouvelle preuve de l'existence de baies ouvertes sur le littoral gascon pendant la période quaternaire. Par Charles Duffart. *With Map.*

Germany—Rivers. *Z. Ges. Erdk. Berlin* (1902): 880–882. **Schjerning.**
Die norddeutschen Ströme. Von Dr. W. Schjerning.

Statistics collected from the official works on the rivers.

Germany—Silesia. *G.Z.* 8 (1902): 553–570. **Frech.**
Ueber den Bau der Schlesischen Gebirge: Eine tektonische Skizze. Von Prof. Dr. Fritz Frech. *With Map and Illustrations.*

Greece—Thera. **Gaertringen and Wilski.**
Thera. Untersuchungen, Vermessungen und Ausgrabungen in den Jahren 1895–1902. Herausgegeben von F. Frhr. Hiller von Gaertringen. Vierter Band. Klimatologische Beobachtungen aus Thera. Bearbeitet von P. Wilski. I. Teil. Die Durchsichtigkeit der Luft über dem Aegaeischen Meere nach Beobachtungen der Fernsicht von der Insel Thera. Berlin: G. Reimer, 1902. Size 13 × 10, pp. 54. *Maps and Diagrams. Price* 8s.

ASIA.

Afghanistan. **Noyce.**
England, India, and Afghanistan. An Essay upon the relations, past and future, between Afghanistan and the British Empire in India. The Le Bas Prize Essay, 1902. By Frank Noyce. London: C. J. Clay & Sons, 1902. Size 8 × 5, pp. xii. and 176. *Price* 3s. *net. Presented by the Publishers.*

A skilful summary of the leading facts in the history of British relations with Afghanistan, from an impartial standpoint, with a forecast of the future of the country.

Armenia. **Rohrbach.**
Vom Kaukasus zum Mittelmeer. Eine Hochzeits- und Studienreise durch Armenien von Paul Rohrbach. Leipzig und Berlin: B. G. Teubner, 1903. Size 10 × 7, pp. viii. and 224. *Illustrations. Presented by the Publisher.*

Asia. *La G., B.S.G. Paris* 6 (1902): 357–362. **Lapparent.**
La genèse du continent asiatique d'après M. Ed. Suess. Par A. de Lapparent.

China. ——
China. Imperial Maritime Customs. I. Statistical Series: Nos. 3 and 4. Returns of Trade and Trade Reports for the year 1901. Part ii. Reports and Statistics for each port, with report on Foreign Trade of China. Shanghai, 1902. Size 11 × 8½, pp. xvi. and 804. *Diagrams. Price* $5.

China, etc.—Botany. **Forbes and Hemsley.**
J. Linnean S., Botany 26 (1889–1902): 1–592.
An Enumeration of all the Plants known from China Proper, Formosa, Hainan, Corea, the Luchu Archipelago, and the Island of Hongkong, together with their Distribution and Synonymy. By F. B. Forbes and W. B. Hemsley, F.R.S.

This volume includes the orders from Stylidieæ to Cycadaceæ, those from Ranunculaceæ to Compositæ having been dealt with in vol. xxiii. (1886–1888). The publication is being continued in vol. xxxvi.

China—Shantung. **Fischer.**
Reise-Eindrücke aus Schantung. Vortrag von Dr. Fischer. (Abteilung Berlin-Charlottenburg der Deutschen Kolonial-Gesellschaft. Verhandlungen 1902/03. Band vii. Heft 1.) Berlin: Dietrich Reimer (Ernst Vohsen), 1902. Size 9 × 6, pp. 24. *Presented by the Publisher.*

Chinese Empire—Tibet. **Launay.**
Miss. Catholiques **34** (1902): 573–576, 587–588, 597–599, 610–612.
Notes sur l'évangélisation du Thibet avant le XIX^e Siècle. Par Adrien Launay. *With Illustrations.*

Cyprus. **Oberhummer.**
Die Insel Cypern. Eine Landeskunde auf Historischer Grundlage von Eugen Oberhummer. Gekrönte Preisschrift. Erster Theil. Quellenkunde und Naturbeschreibung. München: T. Ackerman, 1903. Size 10½ × 7, pp. xvi. and 488. *Maps. Price* 14*s.*

Dutch East Indies. **Weber.**
Siboga-Expeditie. Uitkomsten op zoologisch, botanisch, oceanographisch en geologisch Gebied verzameld in Nederlandsch Oost-Indië 1899–1900 aan boord H.M. *Siboga* onder commando van Luitenant G. F. Tydeman uitgegeven door Dr. Max Weber. Liv. i–ix. Leiden: E. J. Brill, 1901–1902. Size 13 × 10½, pp. (vol i.) 142; (ii.) 32; (iii.) 160 and 16; (iv.) 32; (v.) 46; (vi.) 120; (vii.) 52; (viii.) 54; (ix.) 18. *Map and Illustrations.*

The numbers of the "Livraisons" merely denote the order of issue. Parts 3 and 4 are the first and second monographs of the whole series (sixty-five in all), and give a general description of the expedition and the apparatus used, the others dealing with zoological results.

Persia. *Scottish G. Mag.* **18** (1902): 617–626. **Sykes.**
The Geography of Southern Persia as affecting its History. By Major P. Molesworth Sykes, C.M.G. *With Map and Illustrations.*

Russia—Siberia. *Abrégé B.S. Hongroise G.* **29** (1901): 17–28. **Kiss.**
Séjour de quelques semaines dans les Toundras de Sibérie. Par Jules Kiss. (From *Földrajzi Közlemények* **29** (1901): 157–168.)

Western Asia. **Rohrbach.**
Die wirtschaftliche Bedeutung Westasiens. Von Dr. Paul Rohrbach. (Angewandte Geographie. Hefte zur Verbreitung geographischer Kenntnisse in ihrer Beziehung zum Kultur- und Wirtschaftsleben, I. Serie, 2 Heft.) Halle a. S.: Gebauer-Schwetschke Buch-handlung, 1902. Size 9½ × 6½, pp. 84. *Map.*

AFRICA.

Abyssinia and Sudan. ——
Treaties between the United Kingdom and Ethiopia, and between the United Kingdom, Italy, and Ethiopia, relative to the Frontiers between the Soudan, Ethiopia, and Eritrea. Signed at Adis Ababa, May 15, 1902. [Ratifications delivered at Adis Ababa, October 28, 1902.] (Treaty Series, No. 16, 1902.) London: Eyre & Spottiswoode. Size 9½ × 6½, pp. 6. *Map. Price* 6½*d.*

See note and map in the February *Journal* (p. 186).

Algeria. **Gsell.**
Enquête Administrative sur les Travaux Hydrauliques Anciens en Algérie, publiée par les soins de M. Stéphane Gsell. (Bibliothèque d'Archéologie Africaine. Fascicule vii.) Paris: G. Leroux, 1902. Size 10 × 6½. pp. 144. *Plans and Diagrams. Price* 4*s.* 6*d.*

Congo. **Grenfell.**
The Upper Congo as a Waterway. By the Rev. George Grenfell. Notes to accompany the Author's Map of the River Congo. (From the *Geographical Journal* for November, 1902.) Size 10½ × 7, pp. 14. *Map, in 5 sheets. Price, to Non-Fellows,* 10*s.*; *to Fellows,* 6*s.*

Congo State. **Bourne.**
Civilisation in Congoland. A Story of International Wrong-doing. By H. R. Fox Bourne. With a Prefatory Note by the Right Hon. Sir Charles W. Dilke. London: P. S. King & Son, 1903. Size 9 × 5½, pp. xvi. and 312. *Map. Price* 10*s.* 6*d. net. Presented by the Publisher.*

Congo State—Katanga. *Mouvement G.* **19** (1902): 589–591. ——
La région minière du Katanga. *With Map.*

Spanish Guinea. *B.R.S.G. Madrid* **44** (1902): 17–47. **De la Escalera.**
Los territorios del Muni. Sus condiciones y colonizacion. Por D. Manuel M. de la Escalera.

Spanish Guinea. *B.R.S.G. Madrid* 44 (1902): 70–132. **Montaldo.**
Nuestras colonias en Guinea. Consideraciones técnicas, sociales y politicas. Por Federico Montaldo. *With Diagram.*

Spanish Guinea. *B.R.S.G. Madrid* 44 (1902): 7–16. **Sobral.**
La Guinea española. Por el Sr. Gutiérrez Sobral.

Spanish Guinea. *B.R.S.G. Madrid* 44 (1902): 183–189. **Viñas.**
Demarcación de la Guinea española. Por el Capitan de Estado Mayor Don Emilio Borrajo Viñas.

NORTH AMERICA.

Canada. *Fortnightly Rev.* 72 (1902): 1055–1065. **Hurd.**
The Foreign Invasion of Canada. By A. S. Hurd.

Canada—British Columbia. **Herring.**
Among the People of British Columbia. Red, White, Yellow, and Brown. By Frances E. Herring. London: T. Fisher Unwin, 1903. Size 8 × 5, pp. xvi. and 300. *Illustrations. Price* 6s. *net. Presented by the Publishers.*

Mexico. *B.S.G. y Estad. Rep. Mexicana* 1 (1902): 51–131. **Peñafiel.**
Cuadro sinóptico y estadistico de la República Mexicana formado por la Direccion General de Estadistica, á cargo del Sr. Dr. Antonio Peñafiel.

Mexico—Popocatepetl. *B.S.G. y Estad. Mexicana* 1 (1902): 135–142. **Ochoa.**
Descripcion cientifica del Volcan Popocatepetl por el General Gaspar Sanchez Ochoa.

North America—Historical. **Fiske.**
New France and New Zealand. By John Fiske. London: Macmillan & Co., 1902. Size 8 × 5, pp. xxv. and 378. *Maps. Price* 8s. 6d. *Presented by the Publishers.*

United States. **Leverett.**
Department of the Interior. Monographs of the United States Geological Survey. Vol. xli. Glacial Formations and Drainage Features of the Erie and Ohio Basins. By Frank Leverett. Washington, 1902. Size 12 × 9, pp. 802. *Maps and Illustrations. Presented by the U.S. Geological Survey.*

United States—California. **Davy.**
Stock Ranges of North-Western California: Notes on the Grasses and Forage Plants and Range Conditions. By Joseph Burtt Davy. (U.S. Department of Agriculture. Bureau of Plant Industry -Bulletin No. 12.) Washington, 1902. Size 10 × 7½, pp. 82. *Maps and Illustrations. Presented by the Author.*

United States—Chicago. **Erskine.**
Coal Industry of the Consular District of Chicago. Foreign Office, Miscellaneous, No. 580, 1902. Size 10 × 6, pp. 14. *Price* 1*d.*

United States—Colorado. *J.G.* 1 (1902): 357–370. **Lee.**
Canyons of South-Eastern Colorado. By Willis T. Lee. *With Map and Illustrations.*

United States—Iron. **Erskine.**
Iron Ore Industry of the United States. Foreign Office, Miscellaneous, No. 583, 1902. Size 10 × 6, pp. 16. *Price* 1*d.*

United States—Massachusetts. *J.G.* 1 (1902): 403–407. **Jefferson.**
Flood Studies on Matfield River. By Prof. M. S. W. Jefferson.

United States—Rhode Island. *J.G.* 1 (1902): 343–352. **Brown.**
Gaspee Point. A Type of Cuspate Foreland. By Robert M. Brown. *With Map, Diagram, and Illustration.*

CENTRAL AND SOUTH AMERICA.

Argentine Republic. *B. Démog. Argentin* 8 (1902): pp. 76. **Carrasco.**
Dictionnaire démographique argentin. Por G. Carrasco.

Argentine Republic. **De la Plaza.**
Politica Internacional Argentina. Los últimos arreglos Argentino—Chilenos.

Por V. de la Plaza. Londres: Imp. William Clowes é Hijos, 1902. Size 8½ × 5½, pp. 64.

Written before the recent frontier award was made.

Argentine Republic—Historical. **Outes.**

Félix F. Outes. El primer establecimiento español en el territorio Argentino. Noticia histórico—geográfica (1527 1902). Buenos Aires, 1902: Size 10½ × 6½, pp. 30. *Maps and Illustrations. Presented by the Author.*

Bolivia. ——

Anexos á la Memoria del Ministro de Relaciones Exteriores y Culto presentada al Congreso Ordinario de 1901. La Paz, 1902. Size 11½ × 7½, pp. 300.

A reprint of documents referring to the foreign relations of Bolivia.

Brazil—Meteorology. **Hann.**

Zur Meteorologie des Äquators. Nach den Beobachtungen am Museum Goeldi in Pará. Von J. Hann. (Aus den Sitzungsberichten der Kaiserl. Akademie der Wissenschaften in Wien. Mathem.-naturw. Classe. Bd. cxi. Abth. ii. a. Mai, 1902.) Wien, 1902. Size 9½ × 6½, pp. 70. *Presented by the Author.*

Guiana. *B.G. Hist. et Descriptive* (1902): 253-260. **Froidevaux.**

Un arbitrage français en Guyane, en l'année 1742. Par H. Froidevaux.

Jamaica. **Oliver.**

Jamaica. Report for 1901-2. Colonial Reports—Annual. No. 373. 1902. Size 10 × 6½, pp. 124. *Price 6d.*

Juan Fernandez. *Deutsch. Rundschau G.* **25** (1902): 122 128. **Andresen.**

Juan Fernandez, die Robinson-Insel. Von P. Andresen *With Illustrations.*

Leeward Islands. ——

Leeward Islands. Report for 1901-1902. Colonial Reports, Annual. No. 374, 1902. Size 9½ × 6, pp. 46. *Price 2½d.*

See note in Monthly Record for February (p. 189).

Martinique. *C. Rd.* **135** (1902): 771 773. **Lacroix.**

Sur l'état actuel du volcan de la Montagne Pelée, à la Martinique. Extrait d'une Lettre de A. Lacroix.

Peru. *B.S.G. Lima* **12** (1902): 53-73. **Hassel.**

Importancia de la región amazónica y del proyecto de un ferrocarril entre Piura y el pongo de Mansoriche. Conferencia del G. M. von Hassel. *With Map.*

Venezuela—Caura River. **André.**

The Caura. A Narrative of a Journey up the Caura River. By G. André. Trinidad, 1902. Size 10½ × 8, pp. 80. *Map and Portfolio of Plates. Presented by the Author.*

The journey was described in the *Journal* for September, 1902 (p. 283).

West Indies—Agriculture. ——

Imperial Department of Agriculture for the West Indies. Pamphlet Series. Nos. 12-20. Issued by the Commissioner of Agriculture. 1901-1902. Size 7½ × 5.

Each pamphlet deals with a special subject connected with West Indian agriculture, including that of the results of cane cultivation at the experimental stations at Barbadoes and elsewhere.

West Indies—Volcanic Eruptions. *W. Indian B.* **3** (1902): 271-293. ——

Volcanic Eruptions in the West Indies.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia. **Favenc.**

Brooks's Australian School Series. A Century of Progress, 1788-1888. The Geographical Development of Australia. By Ernest Favenc. Sydney and Brisbane: W. Brooks & Co, [1902]. Size 7½ × 10, pp. 62. *Maps and Sections. Presented by the Author.*

On the history of Australian exploration.

Australia—Ethnography. *J. Museum Godeffroy,* Heft x. (1902): pp. 14. **Virchow.**

Australier. 20 ethnographische und Anthropologische Tafeln, ausgeführt nach Anweisungen und Zeichnungen des Prof. Dr. Rudolph Virchow.

Hawaii. *American J. Sci.* **14** (1902): 431–439. **Emerson.**
Some Characteristics of Kau. By J. S. Emerson.

New Guinea. *Globus* **82** (1902): 379–383. **Foy.**
Ethnographische Beziehungen zwischen British- and Deutsch-Neu-Guinea. Von Dr. W. Foy. *With Illustrations.*

New Guinea—Dutch. *Globus* **83** (1903): 11 14. **Zondervan**
Die Erweiterung unserer Kenntnisse von Niederländisch Neu-Guinea. Von Henri Zondervan.

New Guinea—German. *M. Deutsch. Schutzgeb.* **15** (1902): 243–249. ———
Resultate der Regenmessungen und Erdbeben-Beobachtungen in Deutch-Neu-Guinea in den Jahren 1900 and 1901.

New Zealand—Survey Report. **Marchant.**
Report of the Department of Lands and Survey, New Zealand, for the year 1901–1902. By J. W. A. Marchant, Wellington, 1902. Pp. xxviii. and 166, *Maps and Plates. Presented by the Surveyor-General of New Zealand.*

Pacific. *National G. Mag.* **13** (1902); 333–342. **McGee.**
Problems of the Pacific - The Great Ocean in World Growth. By Dr. W J McGee.

Pacific—Date Line. *Monthly Weather Rev.* **30** (1902): 363. **Page.**
The Date Line in the Pacific Ocean. By James Page.

Samoa. **Krämer**
Die Samoa-Inseln. Entwurf einer Monographie mit besonderer Berücksichtigung Deutsch-Samoas. Von Dr. Augustin Krämer. Herausgegeben mit Unterstützung der Kolonialabteilung des Auswärtigen Amts. Erster Band: Verfassung, Stammbäume und Ueberlieferungen. Stuttgart: E. Schweizerbartsche Verlagsbuchhandlung (E. Nägele), 1902. Size 12½ × 9½, pp. 510. *Maps and Illustrations. Price* 16*m.*

This volume deals almost entirely with the people of Samoa.

South Australia—Lake Eyre. *Library Record Australasia* **2** (1902): 75–77. **Wright.**
The Value of Newspapers—Naming of Lake Eyre. By Hugh Wright.

POLAR REGIONS.

Antarctic. **Wilson.**
Antarctica. By Dr. E. T. Wilson. (Cheltenham Natural Science Society, Session 1901-1902.) (Reprinted from the *Cheltenham Examiner* of October 29 and November 5, 1902.) Size 7½ × 5, pp. 16. *Map.*

Antarctic—Botany. **Wille.**
Mittheilungen uber einige von C. E. Borchgrevink auf dem antarctischen Festlande gesammelte Pflanzen. Herausgegeben von Dr. N. Wille. (Separataftryk af *Nyt Mag. f. Naturvidenskab* B. 40, H. iii. Kr. a 1902.) Size 9½ × 6, pp. 203–222 *Plates. Presented by C. Borchgrevink.*

Arctic. **Abruzzi.**
Osservazioni Scientifiche eseguite durante la Spedizione Polare di S.A.R. Luigi Amedeo di Savoia, Duca degli Abruzzi, 1899-1900. Milan: Ulrico Hoepli, 1903. Size 12 × 8, pp. 724. *Illustrations. Presented by the Publishers.*

Arctic. *G.Z.* **8** (1902): 305–322, 380–390, 570–590, 626–647. **Lindeman.**
Die neueren Reisen zur Erforschung der Nordpolarregion. Von Dr. Moritz Lindeman. *Also separate copy, presented by the Author.*

Arctic—Jan Mayen. *La G., B.S.G. Paris* **6** (1902): 363 369. **Charcot**
Une excursion à Jan-Mayen. Par J. B. Charcot. *With Illustrations.*

MATHEMATICAL GEOGRAPHY.

Cartography—Projection. *B.G. Hist. et Descriptive* (1902): 282–284. **Berthon.**
Une représentation du globe terrestre sur une projection étoilée à quatre branches. Par M. le lieutenant Berthon. *With Map.*

Nautical Almanac. ———
Appendix to Nautical Almanac, 1903. Corrections to the Apparent Places of Nautical Almanac Stars visible at Greenwich, deduced from the Paris Conference (1896) Constants so as to obtain Apparent Places corresponding to the Struve-Peters Constants. [Not dated.] Size 9½ × 6, pp. 22.

Navigation. *B. American G.S.* **34** (1902): 295–297. **Littlehales.**
The Essential Needs of Modern Navigation. By G. W. Littlehales.

Sextants. *Nautical Mag.* 71 (1902): 719–727. **Ellenborough.**
A New Method of correcting Sextants when at Sea. By Lord Ellenborough.

Surveying. *C. Rd.* **135** (1902): 728–730. **d'Ocagne.**
Sur la résolution nomographique du triangle de position pour une latitude donnée. Note de Maurice d'Ocagne.

Surveying. **Berthaut.**
Service Géographique de l'Armée. Les Ingénieurs Géographes Militaires. 1624–1831. Étude Historique par le Colonel Berthaut. 2 Volumes. [Paris.] 1902. Size 11 × 9, pp (vol. i.) xvi. and 468; (vol ii.) x. and 528. *Maps and Illustrations. Price* 30*s*. [To be reviewed.]

Surveying Instrument. *C. Rd.* **136** (1903): 22–27 **Laussedat.**
De l'emploi du stéréoscope en Topographie et en Astronomie. Note de M. le Colonel Laussedat.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Erosion. *C. Rd.* **135** (1902): 1132–1134. **Brunhes.**
Sur le rôle des tourbillons dans l'érosion éolienne. Note de Jean Brunhes.

Geological History. *K.A.W. Amsterdam, P. Sec. Sci.* **4** (1902): 388–399. **Dubois.**
On the Supply of Sodium and Chlorine by the Rivers to the Sea By Prof. Eug. Dubois.

Noticed in the Monthly Record (*ante*, p. 327).

Geomorphology. *C. Rd.* **135** (1902): 1138–1141. **Martel.**
Sur l'origine des lapiaz et leur relation avec les abîmes et l'hydrologie souterraine des calcaires. Note de E. A. Martel. [See note, *ante*, p. 328.]

Glaciers. *B.G. Hist. et Descriptive* (1902): 285–327 **Rabot.**
Essai de chronologie des variations glaciaires. Par Ch. Rabot.

Gravity. *C. Rd.* **135** (1902): 956–959. **Collet.**
La pesanteur le long du parallèle moyen. Note de J. Collet.

Ice-action. *American J. Sci.* **14** (1902): 399–403. **Hobbs.**
An Instance of the Action of the Ice-sheet upon Slender Projecting Rock Masses. By W. H. Hobbs. *With Sketch-map and Illustrations.*

Meteorology. *J.G.* **1** (1902): 441–447. **Jefferson.**
Winter Aridity Indoors. By Prof. M. S. W. Jefferson.

The fact that the author (without discussion) assumes 70° as the normal temperature of the air in houses may incline some to doubt the correctness of his second assumption, that the most suitable relative humidity is 70 per cent.

Oceanography—Currents. *Monthly Weather Rev.* **30** (1902): 397–401. **Page.**
Ocean Currents. By James Page.

Phyto-Geography—Wind-effects. **Früh.**
Jahresb. G.-Ethnogr. Ges. Zürich (1901–1902): 57–153.
Die Abbildung der vorherrschenden Winde durch die Pflanzenwelt. Von Prof. Dr. J. Früh. *With Maps.*

Rivers. *Abh. K.K.G. Ges. Wien* **4** (1902): 1–22. **Ule.**
Die Aufgabe geographischer Forschung an Flüssen. Von Prof. Dr. Willi Ule. *With Diagrams.*

Terrestrial Physics. **Digby.**
Natural Law in Terrestrial Phenomena. A Study in the Causation of Earthquakes, Volcanic Eruptions, Wind-storms, Temperature, Rainfall, with a Record of Evidence.

By William Digby. London: W. Hutchinson & Co., 1902. Size 9 × 5½, pp. xlvi. and 870. *Diagrams. Presented by the Author.*

Written in support of recent theories of the moon's preponderating influence on meteorological and earthquake phenomena.

Tides. *P.R.S.* 71 (1902): 91-96. **Wright.**

Harmonic Tidal Constants for certain Australian and Chinese Ports. By Thomas Wright.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Historical—Columbus. **De la Rosa.**

La Solution de tous les problèmes relatifs à Christophe Colomb et, en particulier, de celui des origines ou des prétendus inspirateurs de la Découverte du Nouveau Monde, par M. Gonzalez de la Rosa. (Mémoire extrait du *Compte rendu du Congrès international des Américanistes*, tenu en Septembre 1900.) Paris: E. Leroux, 1902. Size 10 × 6½, pp. 22. *Presented by the Author.*

Historical—Columbus and Toscanelli. **Vignaud**

The Letter and Chart of Toscanelli on the Route to the Indies by way of the West, sent in 1474 to the Portuguese Fernam Martins, and later on to Christopher Columbus. A Critical Study on the Authenticity and value of these documents and the sources of the cosmographical ideas of Columbus, followed by the various texts of the letter, with translations, annotations, several facsimiles, and also a map. By Henry Vignaud. London: Sands & Co., 1902. Size 9 × 5½, pp. xx. and 366. *Price* 10*s*. 6*d*.

The French edition was reviewed in the *Journal* for June, 1902 (p. 749). In the present version several new chapters have been added, and further arguments adduced.

BIOGRAPHY.

Bienville. *B.G. Hist. et Descriptive* (1902): 184-186. **Musset.**

J.-B. Le Moyne de Bienville. Par G. Musset.

The subject of this notice was a younger brother of the better-known Lemoyne d'Iberville, and, like the latter, took an important part in the French settlement of Louisiana.

Garcie. *B.G. Hist. et Descriptive* (1902): 155-158. **Pawlowski.**

Pierre Garcie, dit Ferrande, et son grand routier. Notice additionnelle. Par A. Pawlowski.

Gives an account of the Rouen edition of 1525 (*cf. Journal*, vol. xviii. p. 315).

Gioia. **Porena.**

Prof. Filippo Porena. Flavio Gioia, inventore della Bussola moderna. (Dalla *Nuova Antologia*—1° novembre 1902.) Roma, 1902. Size 9½ × 6½, pp. 24. *Presented by the Author.*

GENERAL.

Agriculture. **Plessis de Grenédan.**

Geographie Agricole de la France et du Monde. Par J. du Plessis de Grenédan. Paris: Masson & Cie., 1903. Size 9 × 5½, pp. xx. and 424. *Maps and Diagrams. Price* 6*s*.

Bibliography. **Cole.**

Compiling a Bibliography, Practical hints with illustrative examples concerning the collection, recording, and arrangement of bibliographical materials. By George Watson Cole. New York: The *Library Journal*, 1902. Size 9½ × 7½, pp. 20. *Presented by the Author.*

Instructions to Collectors. ———

Handbook of Instructions for Collectors, issued by the British Museum (Natural History). London, 1902. Size 7 × 5, pp. 138. *Illustrations. Presented by the Trustees of the British Museum.*

Irrigation. *J.G.* 1 (1902): 407-419. **Hollister.**

Irrigation Methods. By George B. Hollister. *With Illustrations.*

Year-Book. **Parker.**

The Daily Mail Year-Book for 1903. Third Year of issue. Edited by Percy L. Parker. London: Amalgamated Press Ltd. N.D. Size 7½ × 5, pp. 370. *Maps. Price* 1*s*. *Presented by the Publishers.*

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**

ORDNANCE SURVEY OF ENGLAND AND WALES:—Revised sheets published by the Director-General of the Ordnance Survey, Southampton, from January 1 to 31, 1903.

4 miles to 1 inch:—

Hill-shaded map, printed in colours, in sheets: 7, 8. 1*s.* 6*d. each.*

1 inch:—

With hills in brown or black: 78, 80, (81 and 82), 90, 106, 118, 135, 136 (engraved). 1*s. each.*

6-inch—County Maps:—

Cambridgeshire, 38 N.E., 45 N.E. **Dorsetshire**, 31 N.E., 32 S.W., 48 N.W., S.W., 49 S.E. **Huntingdonshire**, 26 N.E., 28 N.E. **Montgomeryshire**, 10 N.E., 18 S.E., 19 S.E., 22 N.W., S.W., S.E., 23 S.W. **Shropshire**. 3 S.W., 17 S.W., (23 N.E. and 24 N.W.), 25 N.E., 28 S.E., 34 N.E., 40 N.E. **Staffordshire**. 27 N.E., 28 N.E., S.E., 43 S.E., 50 N.W., S.W., S.E., 51 N.E., S.E., 56 S.W., 59 N.W., N.E. **Warwickshire**, 2 N.E. 1*s. each.*

25-inch—County Maps:—

Cambridgeshire, VII. 4, 8; VIII. 9; XIII. 1; XVII. 1, 9; XVIII. 13; XXIII. 6, 15; XXVII. 6; XXXI. 2, 6, 10, 11; XXXVI. 4, 10, 15; XL. 7; XLVI. 15; LIII. 1, 4, 5, 7, 8, 11, 12, 14, 16; LIV. 4, 7, 9, 14; LV. 15; LVIII. 2. **Dorsetshire**, XI. 10; XII. 7, 10, 11, 12, 13, 14, 15, 16; XXI. 1, 2, 3, 6, 10, 14; XXX. 2, 3; LVIII. 6, 7, 12; LX. (2, 6 and 7), 3. **Gloucestershire**, IX. 12; XI. 14; XVII. 9, 10; XXII. 7, 8; XXVI. 5; XXVII. 1, 2, 3, 4, 13, 16; XXIX. 4, 7; XXXIV. 5; XXXVI. 7; XLI. 3, 4; XLII. 3, 4, 7, 11, 12, 16; XLIII. 3. 7; LI. 4; LII. 1, 3, 4, 5, 9, 12; LIII. 5; LVIII. 7, 8, 10, 11; LIX. 11, 12; LX. 10; LXV. 7, 8, 14; LXVI. 1, 2, 6; LXVIII. 11; LXX. 2, 10; LXXIII. 12; LXXIV. 5, 9; **Leicestershire**, IV. 12; V. 14, 15; IX. 7, 10, 11, 14; X. 3, 7, 9, 11; XV. 8; XVII. 6. **Montgomeryshire**, XXXI. 15, 16; XXXVII. 10, 12, 13, 14; XXXVIII. 2, 4, 5, 7, 12, 13, 14, 15, 16; XLIII. 11, 12, 14, 15; XLIV. 1, 3; XLV. 2; XLVIII. 12, 14; XLIX. 8; LII. 3. **Radnorshire**, I. 15; III. 12, 14; IV. 3; VIII. 3, 4, 6, 7. **Shropshire**, XLVII. 12, 15, 16; LIII. 12; LIV. 2, 4, 5, 12, 15, 16; LV. 13, 15; LVII. 11; LVIII. 9, 12; LIX. 1, 5, 11; LXII. 2; LXIII. 2, 3, 6, 9, 10. **Somersetshire**. VII. 12, 16; XC. 10; XCIV. 2. **Staffordshire**. XXXV. 15, 16; XLIX. 1, 8; LXII. 9, 13; LXIII. 11; LXVII. 5; LXX. 11. **Worcestershire and Do. (Det. 6 and 7)**, LIV. 14; LXII. 7, 8; LXIV. 4. **Yorkshire**, CCLXXXIV. 1, 6, 7, 11; CCLXXXV. 16; CCLXXXVI. 2; CCXC. 1; CCXCV. 12. 3*s. each.*

(*E. Stanford, London Agent.*)

England and Wales. **Bartholomew.**

Reduced Ordnance Survey of England and Wales. Scale 1 : 126,720 or 2 stat. miles to an inch. Sheets—16, Aberystwyth; 21, Pembroke; 22, Carmarthen. Edinburgh: John Bartholomew & Co. *Price* 2*s. each. Presented by the Publishers.*

With the publication of these three sheets, Bartholomew's excellent series of half-inch to a mile reduced Ordnance Survey Maps of England and Wales is complete. The maps have already obtained a well-deserved popularity, and their merits are fully appreciated by tourists and cyclists, the manner in which the relief is shown by contours and tinting rendering them specially useful to the latter, who can see at a glance the character of the country his road is to pass over. The sheets are now to be brought together, and will constitute the principal part of the new Survey Atlas of England and Wales about to be issued by Messrs. Bartholomew, and which was specially noticed in the February number of the *Geographical Journal.*

English History. **Reich.**

A New Student's Atlas of English History. By Dr. Emil Reich. London: Macmillan & Co. *Price* 10*s. Presented by the Publishers.*

This atlas is noticed on p. 314.

Europe. **Reger.**

Regenkarte von Europa. Nach neueren Einzelveröffentlichungen zusammengestelt von Joseph Reger. Scale 1 : 12,000,000 or 189·4 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1903. Taf. 1. Gotha: Justus Perthes. *Presented by the Publisher.*

In the letterpress accompanying this map the author gives an account of its compilation, and mentions the authorities upon which it is based. For many countries the data available is very scanty, but in others reliable observation of the rainfall have been made during recent years, and much valuable information accumulated, the results of which have been published either by the respective governments, scientific societies, or by private enterprise. A good example is the 'Atlas Climatologique de l'Empire de Russie,' which appeared in 1900. The map was compiled at the instigation of Prof. Dr. Erk, of the University of Munich.

Germany. **Hellmann.**

Regenkarte der Province Westfalen sowie von Waldeck, Schaumburg-Lippe, Lippe-Detmold und dem Kreis Rinteln. Mit erlauterndem Text and Tabellen. In amtlichen Auftrage bearbeitet von Prof. Dr. G. Hellmann. Scale 1 : 1,000,000 or 15·7 stat. miles to an inch. Berlin: Dietrich Reimer (Ernst Vohsen), 1903.

This little rainfall map is one of a series of different parts of the German Empire which is now in course of preparation by the author. With the above seven are now published, and others are to follow shortly. The map shows the mean annual rainfall in seven different tints of blue, ranging from 500 millimetres to over 1200 millimetres, and is accompanied by twenty-nine pages of tabular matter and text, giving very complete particulars concerning the rainfall at different stations in certain intervals of time, the monthly means, the change of rainfall from year to year, and similar subjects.

ASIA.

Asia Minor. **Diest.**

Karte des nordwestlichen Kleinasien. Nach eigenen Aufnahmen und unveröffentlichem Material auf Heinrich Kiepert's Grundlage neu bearbeitet von Walther v. Diest. Scale 1 : 500,000 or 7·8 stat. miles to an inch. Blatt A. Berlin: Alfred Schall, 1903. *Price 5m.*

Upon the late Dr. H. Kiepert's well-known map of Western Asia Minor as a basis, Major W. v. Diest has shown the results of his own surveys, combined with recent information. The present sheet includes the Dardanelles, the Sea of Marmora, Constantinople, the Bosporus, and the country to the south. It also contains the title, index, plan, and list of abbreviations and symbols employed, as well as important notes on the nomenclature. The map will consist altogether of four sheets. The relief of the country is shown by hill-shading—in places somewhat too light to be effective—and the principal valleys and plains are tinted green. All water is shown in blue.

Asiatic Russia. **Imperial Topographical Institute, St. Petersburg.**

Map of Asiatic Russia. Scale: 1 : 3,900,000 or 61·5 stat. miles to an inch. 9 sheets. [In Russian characters.] St. Petersburg: Imperial Topographical Institute, 1894. Revised and corrected up to November, 1902. *Presented by Colonel J. de Shokalsky.*

The present edition of this map is dated 1894, but a note in manuscript appears on the title-sheet, stating that it has been corrected up to last November. Although this may be true as regards certain districts, it is evident that the map requires further revision. The new survey of the Yenesei has not been taken advantage of, and there are other matters that need attention. However, a comparison with the first edition, which appeared in 1884, shows that a great deal of correction has taken place since that date.

AFRICA.

Africa. **Intelligence Division, War Office.**

Africa. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Sheets: (Provisional) 45-H, Talgwarab; (Provisional) 45-L, Adarama; (Provisional) 46-A, Suakin; (Provisional) 46-E, Sinkat; (Provisional) 46-F, Tokar; (Provisional) 55-B, Khartoum. London: Intelligence Division, War Office; Stanford, 1902. *Price 1s. 6d. each sheet. Presented by the Director-General of Mobilization and Military Intelligence.*

These sheets include the district between Berber and Suakin, and the neighbourhood of Khartum. They form part of the important large map of Africa now being

prepared at the Intelligence Division of the War Office. Much fresh information is given from the surveys of various officers and others serving in the Sudan, and upon each sheet there appears a note stating the sources from which this has been derived.

Nigeria. **Woodroffe.**

Map of Southern Nigeria (Provisional). Compiled under the direction of Captain A. J. Woodroffe, R.E. Scale 1 : 500,000 or 7·8 stat. miles to an inch. 2 sheets. London: Edward Stanford, 1902. *Price* £1 1*s*.

The principal geographical results of the recent Aro expedition are shown upon this map, as well as other up-to-date information obtained from various sources, but many of the sites of villages, rivers, and native paths can only be considered as approximate, owing to the fact that they have been laid down during hurried journeys through very difficult country. The map is printed in blue and black, and extends from Lagos on the west to the river Kamerun on the east, and from the sea to lat. 7° 30′ N. It is stated to be a provisional issue only, and doubtless another and more complete edition will be published when fresh information is available.

South Africa. ——

The Railway Map of South Africa. Scale 1 : 4,118,400 or 65 stat. miles to an inch. Supplement to *South Africa*, December 13, 1902. London: Offices of *South Africa*, 1903.

Shows railways open, under construction, and proposed between Cape Colony and the south of the Tanganyika. There is also a table giving the distance in miles between the stations on the different lines, and the height of the stations in feet above sea-level. Plans of nine of the principal ports are added as insets, as well as a general outline map of Africa illustrating the Cape to Cairo route and the Natal railways.

Togo. **Sprigade.**

Karte von Togo. Scale 1 : 200,000 or 3·1 stat. miles to an inch. Konstruiert und gezeichnet unter Leitung von Paul Sprigade. Im Auftrage und mit Unterstutzung der Kolonial-Abteilung des Auswärtigen Amts, herausgegeben durch die Verlagshandlung. Sheet: E 2, Lome. Berlin: Dietrich Reimer (Ernst Vohsen), 1903. *Price* 1.80*m. each sheet.*

This is the first sheet of a large map of Togoland, now in course of publication. It is carefully compiled from the route surveys of various explorers, which are indicated with the travellers' names and the dates of their journeys. It is well drawn, clearly printed, and gives a considerable amount of detail, although many districts are still but imperfectly known.

West Africa. **Mager.**

Atlas d'Afrique Occidentale. Par Henri Mager. Paris: Ernest Flammarion. *Price* 1*fr*.

A cheap popular little atlas of French West Africa, consisting of two sheets of maps from the author's 'Nouvel Atlas Colonial,' with descriptive letterpress, to which additions have been made. There is also a small general map of North-West Africa.

AMERICA.

Argentine and Chile. **Steffen.**

Grenze zwischen Argentinien und Chile nach dem Shiedsspruch v. 20 Nov. 1902. Von Dr. H. Steffen. Scale 1 : 2,500,000 or 39·45 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahr. 1903, Tafel 1. Gotha: Justus Perthes. *Presented by the Publisher.*

Canada. **Surveyor-General's Office, Ottawa.**

Sectional Map of Canada. Scale 1 : 190,080 or 3 stat. miles to an inch. Qu'Appelle Sheet (35), West of Second Meridian. Revised to September 30, 1902: Willowbunch Sheet (41), West of Second Meridian. Revised to September 20, 1902. Surveyor-General's Office, Ottawa, 1902. *Presented by the Surveyor-General of Canada.*

The Willowbunch sheet includes the area approximately between 49° and 49° 42′ N. lat. and between 104° and 106° W. long., and the Qu'Appello sheet that between 50° 25′ and 51° 5′ N lat. and between 102° and 104° W. long. The sheets

show townships, trails, post-offices, and railways, in addition to an indication of the topographical features.

Colombia. **Lidstone.**

Map of a part of the Republic of Colombia. By William Lidstone, C.E. Scale 1 : 810,000 or 14·1 stat. miles to an inch. 2 sheets. London: Edward Stanford, [1903]. *Price* 15*s*.

The title of this map is decidedly vague and indefinite, but the "part" of the Republic of Colombia it refers to as shown on the map, includes the departments of Bolivar, Magdelena, Santander, Antioquia, Tolima, the western part of Boyaca and Cundinamarca, and the eastern half of Cauca. The map thus represents all the central and most important region of Colombia, including the capital and the courses of the rivers Magdelena and Cauca. The geographical features of this country are still very imperfectly known, and, with the exception of the route-surveys of mining engineers and a few others, little additional information is to be obtained that is not given on Codazzi's large atlas which was published over sixty years ago. Any addition to our knowledge is therefore specially welcome. Mr. Lidstone, the author of this map, in the pursuit of his profession as a civil engineer, has travelled extensively in the country, and from his route-surveys, combined with other information, this map has been compiled. In many districts, however, the map is not nearly so complete as it might have been if the surveys of others had been properly utilized. An instance of this is to be found in the northern part, where Mr. F. A. A. Simons has worked for years, but the results of whose surveys seem to have been almost entirely ignored. Had the information contained on his maps of the departments of Bolivar and Magdelena and of the river Sinú been made use of, Mr. Lidstone could have rendered his map far more complete. The map is printed in colours, and shows railways existing and in course of construction.

United States. **Rand, McNally & Co.**

Indexed County and Township Pocket Maps. Mississippi. Scale 1 : 823,680 or 13 stat. miles to an inch. Missouri. Scale 1 : 1,013,760 or 16 stat. miles to an inch. Montana. Scale 1 : 1,900,800 or 30 stat. miles to an inch. Chicago and New York: Rand, McNally & Co., 1903. *Price* $0.25 *each*. *Presented by the Publishers.*

These are new editions.

GENERAL.

Illustrations. **Martin.**

Wall illustrations for anthropological, ethnographical, and geographical instruction. By Dr. Rud. Martin. Zurich: Art. Institut Orell Füssli. *Presented by the Publishers.*

There can be no doubt that a really carefully prepared series of wall illustrations of the leading types of the human race would prove valuable for educational purposes, and such it is the intention of the author of the above, Dr. R. Martin, of Zurich University, to produce. Each illustration is to give a half-length photochrome picture, larger than life size, taken from original photographs by the author, or by well-known scientists and travellers, who have undertaken to assist in the matter; and from these and other reliable material, Mr. W. v. Steiner has, under Dr. R. Martin's direction, painted the originals from which the diagrams have been copied. The specimens already received are of the Great Russian, Veddah, and Javanese types. There are to be two editions of the series, a small one, consisting of eight pictures, containing types of the Veddah, Javanese, Australian, Masai, Melanesian, Dakota, Eskimo, and Great Russian, for which the subscription price is £1 8*s*.; and a larger one consisting of twenty-four pictures, illustrating the following types in addition to those already mentioned: Egyptian, Senoi, Semang (Negrito), Chinese, Bushman, Tamil, Carib, Polynesian, Karen, Batta, Dahomey, Micronesian, Kirghiz, Solomon islander, Samoyed, and Fuegian. For this latter series the subscription price will be £3 4*s*. The diagrams are to be issued in portfolios, and accompanied by explanatory letterpress.

Roman Empire. **Grundy.**

Murray's Handy Classical Maps. The Roman Empire. Edited by G. B. Grundy, M.A., of Brasenose College, Oxford. London: John Murray. *Price* 1*s*. *Presented by the Publisher.*

Noticed on p. 314.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during November and December, 1902. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
3281 m =	16·0	England, south coast:—Portsmouth harbour, mooring ground, southern sheet. 2s. 6d.
2175 m =	4·0	England, south coast:—Poole harbour. 2s. 6d.
1607 m =	1·4	England:—River Thames entrance, North Foreland to the Nore. 3s.
3278 m =	30·4	Channel islands, Jersey:—St. Helier harbour. 2s. 6d.
2361 m =	1·45, 5·7, 7·2	Germany, Elbe river:—Outer light-vessel to Brunsbüttelkoog (Plans:—Cuxhaven road, Kaiser Wilhelm canal entrance, Brunsbüttelkoog). 4s.
3262 m =	1·45, 5·7	Germany, Elbe river:—Brunsbüttelkoog to Hamburg. Plans: Hamburg and Altona harbours. 2s. 6d.
3303 m =	5·0	Black sea:—Batúm bay. 1s. 6d.
3288 m =	4·0	Newfoundland:—Northern arms of Canada bay. 2s. 6d.
3308 m =	2·0	Newfoundland: Little river. 1s. 6d.
3310 m =	2·0	Newfoundland:—Bay of Islands, outer part. 2s.
3316 m =	5·0	West Indies, Puerto Rico, south coast:—Guayanilla harbour. 1s. 6d.
3298 m =	7·15	West Indies, Puerto Rico, east coast:—Ensenada Honda and Puerca bay. 1s. 6d.
3304 m =	0·25	South America, east coast:—Rio de Janeiro to St. Sebastião island. 2s. 6d.
602 m -	5·8	British Columbia:—Roche harbour and approaches. 1s. 6d.
3313 m =	0·63	North America, west coast, Alaska:—Yakutat (Bering) bay. 1s. 6d.
688 m =	2 2	Madagascar:—Tamatave. 1s. 6d.
3289 m =	3·0	Red sea:—Port Berenice. 1s. 6d.
3312 m =	0·96	Eastern Archipelago:—Madura island, south coast:—Bundor road. 1s. 6d.
3311 m =	var.	Eastern Archipelago:—Anchorages on the north coast of Java. 2s. 6d.
3314 m =	4·85, 2·63	Philippine islands. Anchorages on the west coast of Luzon:—San Fernando harbour, Port Santo Tomas. 1s. 6d.
3309 m =	24·0	Japan, gulf of Tokyo:—Uraga harbour. 1s. 6d.
28 m =		England, south coast. Plan added:—Salcombe harbour.
320 m =		North American lakes. Lake Superior. Plans added:—Michipicoten harbour, Gargantua harbour.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.	Cancelled by	No.
2220 Batúm. Plan on this chart.	New plan. Batúm bay	3303
14 Port Berenice. Plan on this sheet.	New plan. Port Berenice	3289
2454 Port San Fernando. Plan on this chart.	New plan. San Fernando harbour—on sheet . . .	3314

Charts that have received Important Corrections.

No. 28, England, south coast:—Salcombe river. 34, England, south coast:—The Scilly isles. 2390, Scotland, west coast:—East and west lochs Roag. 2311, Norway, sheet ix.:—Fleina to Vestfiord and the Lofoten islands. 2302, Gulf of Bothnia, sheet vii.:—Tome point round the head of the gulf to Tauvö 2647, France, west coast:—Les Sables d'Olonne to Bourgneuf. 853, United States, east coast:—St. Andrew sound to St. John river. 130, Leeward islands:—Anguilla to Puerto Rico with approaches to Virgin islands. 1799, Central America, east coast:—Boca del Drago. Boca del Toro. 1358, South America, east coast:—Union bay to Rio Negro. 1544, Central America:—Panama road. 2087, Africa, south coast:—Bashee river to Umtavuna river. 2088, Africa, south coast:—Umtavuna river to Tugela river. 2089, Africa, east coast:—Tugela river

to Delagoa bay. 648, Africa, east coast:—Delagoa bay to river Zambezi. 685, Africa, east coast:—Bazaruto bay. 1810, Africa, east coast:—River Zambezi to Mozambique harbour. 1809, Africa, east coast:—Mozambique harbour to Ras Pekawi. 658, Africa, east coast:—Ras Pekawi to Cape Delgado. 1808, Africa, east coast, sheet viii.:—Cape Delgado to Kilwa. 690, Africa, east coast:—Cape Delgado to Mikindani bay. 662, Africa, east coast:—Kilwa point to Zanzibar channel. 1032, Africa, east coast:—Channels between Ras Tikwiri and Mafia island. 664, Africa, east coast:—Zanzibar to Malindi. 640A, B, Africa, east coast:—Pangani to Ras Kimbiji. 2 sheets. 1390, Africa, east coast:—Chale point to Pangani. 848, Africa, east coast:—Malindi to Juba. 759A, Madagascar:—Cape St Andrew to Bovato island. 2762, Indian ocean islands:—Comoro islands. 40, India, west coast:—Karachi harbour. 934, Eastern Archipelago:—Surabaya, Bali and Sapudi straits, etc. 3019, Japan:—Tsu Saki to Kagara Sima, with the channels to Imari. 651, Japan:—Bungo channel.

(*J. D. Potter, Agent.*)

North Atlantic Ocean and Mediterranean Sea. **Meteorological Office, London.**

Pilot Chart of the North Atlantic and Mediterranean for February, 1903. London: Meteorological Office. *Price 6d. Presented by the Meteorological Office, London.*

United States Chart. **United States Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for January, and of the North Pacific Ocean for February, 1903. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Central Africa. **Beringer.**

Twenty Photographs of Central Africa. By Otto L. Beringer, Esq. *Presented by Otto L. Beringer, Esq.*

The surveying expedition in connection with the Trans-Continental Telegraph line, during which these photographs were taken, was described in the number of the *Geographical Journal* for January last. The photographs are small, some being taken with a binocular camera.

(1) Camp off road, Tanganyika plateau; (2) High grass, Tanganyika plateau; (3) Fife, Tanganyika plateau; (4) View of the African Trans-Continental Telegraph Company's telegraph line; (5) Abercorn, main road passing Lake Chiuta; (6) Surveying on the shores of Lake Chiuta, Abercorn; (7) An Awemba; (8) Section of tree under which Dr. Livingstone's heart was buried; (9) Folding boat on small Chiuta lake, Abercorn; (10) An Atonga; (11) S.S. *Adventure*, Lake Nyasa; (12) Usysia; (13) Domira bay; (14 and 15) North of Usysia; (16–18) Ficus, near Usysia; (19) Camp on shore between Deep bay and Karonga; (20) Looking south between Usysia and Deep bay.

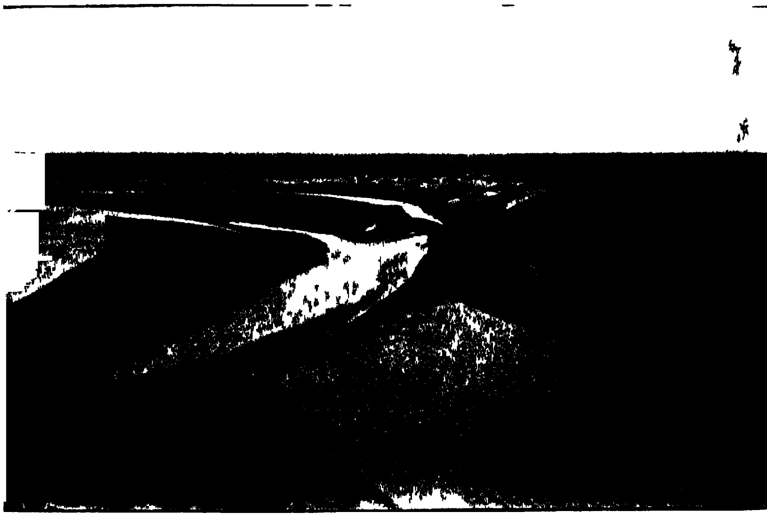
Yunnan. **Watts-Jones.**

Twelve Photographs of Yunnan, taken by Captain W. A. Watts-Jones, R.E. *Presented by Mrs. Watts-Jones.*

These photographs were taken by the late Captain Watts-Jones during his explorations in Yunnan in 1900. Although small in size, they are remarkably clear.

(1) Ferry on the Mekong river; (2) A side lagoon, Tali-fu lake; (3) Yangtse river at Shih-Ku; (4) First stage on Bhamo-Tali-fu road; (5) Marble temple near Tali-fu; (6) Chain suspension bridge over the Shweli river; (7) Waterfall where the river leaves Momein plain; (8) Canal north of Tali-fu; (9) Remains of ancient lake-bed plain, Nan-tien valley; (10) Rice terraces, Shunning-fu valley; (11) Chinese Shan village in Taoping valley; (12) Nan Ting valley.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.



SAND DUNES NEAR THE RIGHT BANK OF THE LOWER TARIM

SAND DUNES ON THE RIGHT BANK OF THE TARIM, NEAR YANGI-KOLL.

The

Geographical Journal.

No. 4. APRIL, 1903. Vol. XXI.

COLONIZATION AND IRRIGATION IN THE EAST AFRICA PROTECTORATE.*

By R. B. BUCKLEY, C.S.I.

The British Empire possesses in the East Africa Protectorate a dependency of which the value and advantages are at present but little known. The protectorate has been described as the America of India, since it offers opportunities for colonization by the natives of that country. It has a coast-line some 400 miles in length on the Indian ocean, lying between Italian East Africa and German East Africa, and extending from the equator to about the fifth degree of southern latitude. The boundary on the south-west is the Anglo-German frontier, which is, more or less, a straight line extending from the coast at Vanga to the point on Lake Victoria Nyanza where 1° of southern latitude cuts the east coast of the lake. To the west lies a portion of the coast of Lake Victoria Nyanza and the Nzoia river, dividing the East Africa Protectorate from the British Protectorate of Uganda. This boundary has lately been altered so as to include, in the East Africa Protectorate, the country lying generally to the east of the lake. The northern boundary is still indefinite, and, owing to the vagueness of this boundary, the area of the East Africa Protectorate is also indefinite, but it may be roughly stated at about 280,000 square miles,† exclusive of the newly added tract, which is about 28,000 to 30,000 square miles in area. A material portion of this area, especially towards the north, is unexplored. The population of the original protectorate, excluding the newly added

* Read at the Royal Geographical Society, January 27, 1903. Map, p. 484.
† 'Précis of Information' concerning East Africa Protectorate, p. 26.

tract, is estimated at two and a half millions, but this figure is to a large extent conjectural, and nearly one-half of the population resides in the territory which is not under direct administration, and where the estimate of the numbers is a mere guess. The better-known parts of the East Africa Protectorate contain a very small * population to the square mile. Thus, in the province of Seyidieh the population is about seventeen persons to the square mile in an area of about 10,000 square miles; in Tanaland it is only about three to the square mile in a tract of some 34,000 square miles; Ukamba has the thickest population of any of the provinces into which the protectorate is divided, but there are only about twenty persons per square mile over some 53,000 square miles; while that part of the province of Jubaland which is explored has less than two persons to the square mile over about 17,000 square miles of country. The population of the newly added province is not known, but it is thin. The average population of the entire protectorate may be put down at about ten to twelve persons per square mile.

The traveller, passing through the heart of the East Africa Protectorate by the Uganda railway, cannot avoid noticing four important facts. First, the rich nature of the soil generally; secondly, the almost entire absence of cultivation; thirdly, the very small discharge in such streams or rivers as he may come across; and, lastly, the extreme paucity of the population. He will certainly see more zebra, antelope, and ostrich than human beings from the windows of the railway carriage.

The climate of the East Africa Protectorate varies, as might be expected, with the elevation of the lands above the sea. The country lies almost entirely within 4° north or south of the equator, and it is difficult to realize that in the very heart of the tropics a climate can be found which is so pleasant as that which actually exists in a considerable area of it. Near the coast the thermometer rarely falls below 70° Fahr., and it rarely rises above 90°; the monthly mean of the maximum temperatures in Mombasa in the coolest months (March and April) is about 89° or 90°, and the monthly mean of the minimum temperatures is about 70° or 71°. In these parts the climate is damp and enervating. But in the higher lands, say those which are 5000 feet or more above the sea, the climate is very different; the thermometer rarely rises above 80°, and often falls below 60°. The returns at Machakos and Fort Smith (5000 to 6000 feet above the sea) show that the monthly mean of the maximum temperatures is rarely more than 70°, although the actual maxima for short intervals are of course higher, and that the monthly mean of the minimum temperatures is rarely above 60°, and it falls at times as low as 50° or even 40°. This is the part of the country to

* Page 34 of 'Précis of Information.'

which reference will be made later, where the white man might live and flourish.

The rainfall, which is such an important factor as regards the agricultural prospects of the country, may be said to average about 40 inches in the year at the coast, and about 36 inches in the lands lying at a higher elevation than 5000 feet. On the banks of Victoria Nyanza, at a level of about 3700 feet above the sea, the rainfall is greater, and it averages from 50 to 70 inches in the year. The following statement is taken almost entirely from the *Report* of 1901 of the British Association for the Advancement of Science (p. 395):—

	Coast.						Inland.				
Year.	Kisimayu, 0° 22′ S by 42° 3′ E.	Malindi, 3° 13′ S. by 40° 7′ E.	Lamu, 2° 16′ S. by 40° 5′ E.	Takaunga, 3° 41′ S. by 39° 5′ E.	Mombasa, 4° 4′ S. by 39° 4′ E.	Chuyu and (Wanga) Shimoni, 4° 6′ S. by 39° 3′ E.	Kibwezi, 2° 25′ S. by 37° 5′ E.	Machako's, 1° 31′ S. by 37° 2′ E	Fort Smith (Kikuyu), 1° 14′ S. by 36° 4′ E.	Munia's Kavirondo, 0° 20′ N. by 34° 3′ E.	Nairob
1890 ...	—	—	29·0	—	34·7	—	—	—	—	—	—
1891 ...	—	42·0	—	—	46·6	—	—	—	—	—	—
1892 ...	—	30·1	—	32·1	26·4	—	—	—	—	—	—
1893 ...		50·8	44·5	40·7	64 2	66·3	—	—	53·0	—	—
1894 ...	13·7	28·9	21·1	38·0	38·0	42·0	26·7	42·0	48·1	—	—
1895 ...	—	31·9	—	35·7	34 3	38·5	33·1	—	65·0	—	—
1896 ...	19 5	53 6	41 3	47·8	65 2	56·6	21·7	25·9	29·5	58·8	-
1897 ...	19·9	58·0	32·3	54 4	52 6	56·7	21 5	31·7	36 3	93 5	—
1898 ...	10·9	14·4	12·4	24·0	25 0	27·3	—	24·3	36·2	69·1	—
1899 ...	12·4	33·4	22 0	33·1	35·2	52·5	—	21 8	—	—	—
1900 ...	12·9	37·0	—	58·1	61·7	59·8	—	58·3	—	50 0	42·4
1901 ...	—	—	—	—	—	—	—	—	—	—	38·8
Average	14·9	38·3	28·9	40·4	44·0	50·0	25·7	34 0	44·6	67·8	40·6

The monthly rainfall statistics of the places included in the above table show that near the coast the south-west monsoon causes heavy rain in April and May, some 20 to 30 inches falling usually during these months; light falls occur from June to October, and in November the fall is generally heavier; December to March are dry months. In the higher land, above 5000 feet, the heaviest falls are usually in March, April, and May; a dry season follows from June to October, when there is usually a second period of rain in November or December.

Falls of more than 5 inches in twenty-four hours appear to occur very rarely; falls of more than 4 inches are not frequent. The records which exist are about to be supplemented by the institution of rainfall stations along the railway at intervals of about 40 miles; it seems most desirable that the meteorological observations of the protectorate should be digested and tabulated on some authorized system; at present the

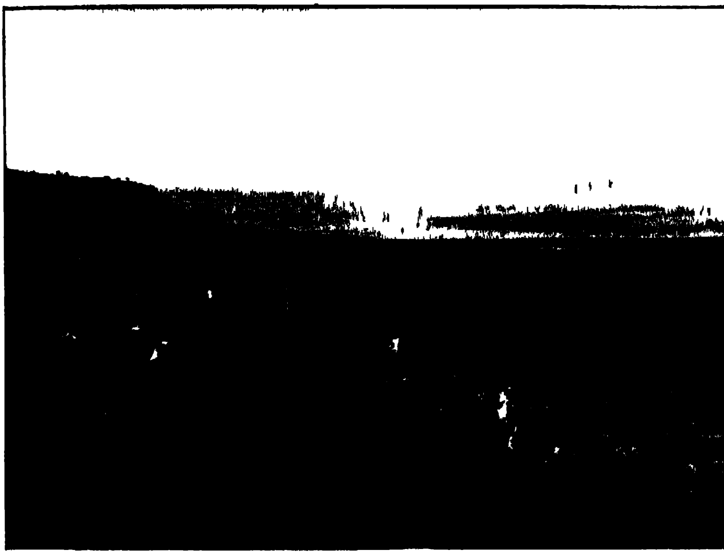
2 A 2

records are not kept in a uniform manner, and are not readily accessible. They are most important.

The agricultural possibilities of the East Africa Protectorate are not as yet well known. Cocoanuts, mangoes, oranges, lemons, pineapples, plantains, flourish near the coast. Maize, rice, sweet potatoes, are cultivated to some extent. In the interior millets, sweet potatoes, and Indian corn are the chief crops; these are grown without irrigation, but often in a more or less uncertain manner, and the crop is said to be not only uncertain, but in most cases very light. Large quantities of rice, flour, and grain are imported at Mombasa; the Indian workmen who have constructed the Uganda railway have been mostly fed on imported grain. The soil in the higher lands consist largely of that commonly called "black cotton" soil, but there is also a red soil over a considerable portion of the uplands, which is said to be even more fertile than the black one. The higher lands are, to a large extent, volcanic, and there are steaming springs on the west side of the Great Rift-valley.

Throughout the district traversed by the railway it is universally said that crops suitable to the various elevations could be grown at almost any place with irrigation. There seems to be little doubt that this is a fact. It does not, however, appear to have been established that irrigation is, in all cases, essential. It is a fact that in some parts, more particularly in the higher lands, crops of potatoes, onions, wheat, barley, etc., are grown without irrigation: but the outturn is very far below that of irrigated crops. It seems quite possible that, when the seasons have been more fully investigated and the proper periods for planting particular crops are better known, suitable crops may, in years of normal rainfall, be successfully cultivated on a large scale without irrigation. But it cannot be asserted that this is a fact. It may be that, although the temperature and rainfall appear suitable for certain crops which are not at present grown, the evaporation and absorption may, under the influence of the tropical sun, be too great for them. It would seem most desirable that experiments should be made to determine this point.

There can, on the other hand, be no doubt that, with irrigation, the agricultural prospects are favourable. This is shown by the fact that at almost every railway station where there is any spare water available from the engine-tanks, the Indian workmen make little gardens in which vegetables grow luxuriantly. The guard of one ballast train had mint, chillies, potatoes, and radishes growing well, but he said they needed frequent waterings, or the plants were scorched up by the strong sun and rich soil. In the settlement of Nairobi, where the staff of the railway is established, all English vegetables can, with irrigation, be grown at all seasons. Peas, cabbages, lettuces, and potatoes can be had at any time of the year. Potatoes, which are now mainly supplied from France, have done particularly well, and it seems possible that the trade



BETWEEN GILGIL AND LBURRU

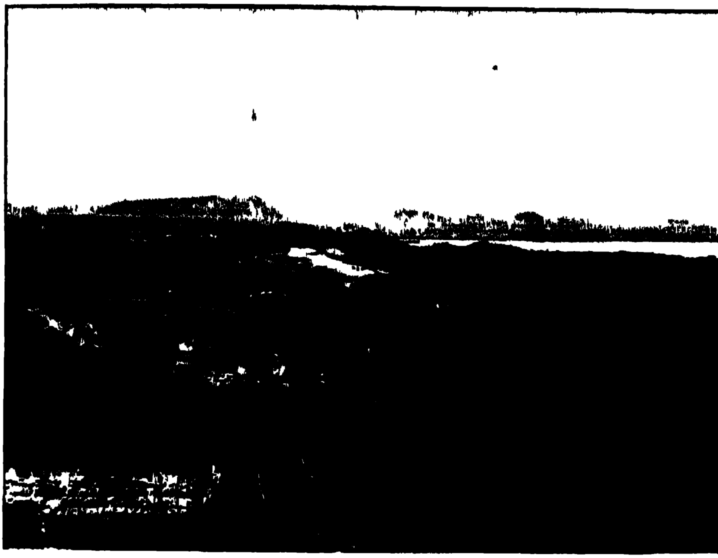
in them may extend to the ports on the East Coast of Africa. The manager of the Uganda railway has arranged a through rate for potatoes with the B.I S.N. Companies' steamers, and specimen consignments have been sent to the south, and even to Durban and Natal. The vast rolling plains of grass, in which the zebra and antelope now find abundant pasturage, might, there seems little reason to doubt, be turned into sheets of wheat, oats, and other cereals, possibly without, but certainly with irrigation, where that is possible. These plains lie in the temperate tracts where Europeans can live in fair comfort, and if they will, they might, to some extent at any rate, labour with their own hands. The climate and soil in these parts seem suited for European fruits and vines, and it is most probable that the few available sources of irrigation would be most advantageously employed in their cultivation.

The Uganda railway, which is now practically completed, is a magnificent monument to the skill, perseverance, and energy of the engineers who have designed and constructed it. The railway rises from the level of the sea at Mombasa, with a maximum gradient of 2 feet in 100, to a height of 8320 feet above the sea, and then it drops again to 3770 feet at the shores of Lake Victoria Nyanza. Throughout its length of 584 miles from the sea to the lake the railway is rarely on the flat, and its course is rarely in a straight line. It is almost always twisting and winding among the hills, and, at the same time,

either raising itself on gradients, often as steep as 1 in 50, over some eminence, or dropping into a valley at the same rate of descent. At the Kikuyu escarpment the lines wind down some 1400 feet, by a series of skilfully designed benches in the hillside, into the Great Rift-valley; then on the further side of that wonderful depression they rise more than 2000 feet again, up the steep slopes of the Mau escarpment. In its course the railway passes through tracts of country which vary almost as much as the plains of the valley of the Ganges vary from the highlands of Scotland. Some 40 miles from the coast the pitiless Taru wilderness, which has absorbed so many human lives, stretches for a length of some 60 or 70 miles, and in that length the rails are raised from 600 to 1800 feet above the sea. The wilderness is covered with scrub jungle, and the soil is said to be productive; but it is waterless and almost devoid of any form of life. In parts the railway has pushed its way through thick forests, mostly in black loamy soil of considerable depth; in others it rises and falls over rolling grassy plains of vast extent, which are thick with game feeding on the luxuriant pasture.

It will be readily understood that the engineers had no small physical difficulties to contend with in such a country. It had from the first been determined that the railway should be so constructed that the trains should always proceed with the engines in front of them, and that "reverses" should not be allowed on the permanent line. If they had been permitted, it would have been comparatively easy to

BETWEEN RAILWAY AND SNOWDON'S CAMP



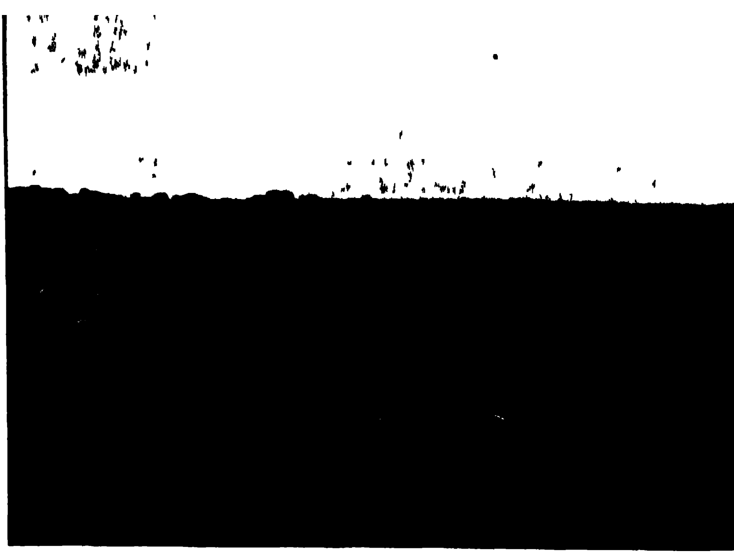
CARANDU VALLEY AND LAKE ELMENTEITA

have climbed, by a series of zigzags, up and down the steep hillsides. But this would have involved the dangers, which are inseparable from such a system, under which a broken coupling might, and probably would, wreck a train; or an inexperienced or careless driver might easily overrun the dead end of a "reverse," and either launch his train over a precipice or drive it into a cliff. An alignment had to be sought out, often in thick jungle, on which rails could be carried straight ahead with a maximum gradient of 1 foot fall or rise in every 50 feet of length; numerous trial lines had to be run and experimental drifts cut through the jungle to determine the right course to pursue. The result must be pronounced a masterpiece in engineering skill. It must not, moreover, be forgotten that the engineering difficulties were not the only ones which had to be overcome. The natives of the country were few in number, unskilled, and, with very few exceptions, quite unwilling to work; consequently nearly the whole of the labour force was obtained from India. In many parts there was little or no water, and absolutely no food for the workmen; special arrangements were consequently necessary to carry water by the railway itself, as it was made, and to import and deliver grain for the workmen at the points where work was progressing. In parts wild animals were a serious source of danger, and special arrangements had to be made, which were not always successful, for the protection of the workmen from lions.

The Uganda railway, in addition to the political effects of its

construction, must have, and indeed already has had, a marked effect on the habits and mode of life of the natives. It has brought them into immediate contact with civilization, and opened up possibilities of trade. It has calmed inter-tribal animosities, and checked the feudatory raids of the aggressive races. It has opened up the whole of the countries lying near the coast-line of the Victoria Nyanza lake to comparatively easy communication with the sea and with Europe.

Lake Victoria Nyanza is about half the size of England. The surveys of it are most imperfect as yet, and the shores are but partially explored. There is a survey of the northern part, which shows the coast-line and the islands lying between Fort Florence and Entebbe, the capital of the Uganda Protectorate. A small steamer, which was laboriously carried up partly by rail, partly by cart, but mainly by porters from the coast, runs between those two places, but it will shortly be supplemented by two much larger ones, which the Uganda Railway Administration is now constructing on the shores of the lake, to navigate it, and to carry to the railway terminus at Port Florence the trade which the country bordering on the lake may supply. The survey which has been made shows that, in addition to the many visible islands which are dispersed over the northern portion of the lake, and which are in themselves dangerous to navigation by night, there are hidden dangers in the shape of rocks which lie below the surface. The new steamers which will shortly float on Nyanza will need to proceed with great caution when venturing into unexplored waters, and a



PORT ALICE, VICTORIA NYANZA.

detailed survey is being made by Commander Whitehouse. It is at present impossible to tell where a sunken and invisible rock may not lie beneath the surface. This danger is increased by the fact that the level of the water in the lake varies from month to month and from year to year, so that a sunken rock which may at one time be at a safe distance under water, would at another time wreck a boat which happened to pass over it. It would be a work of some difficulty to find and demarcate these rocks.

The fluctuating level of Victoria Nyanza is a matter of great interest, both to engineers who may regard the lake as a vast reservoir from which the summer supply of the Nile might possibly be increased, and to students of physical geography. Since 1896, records of the level

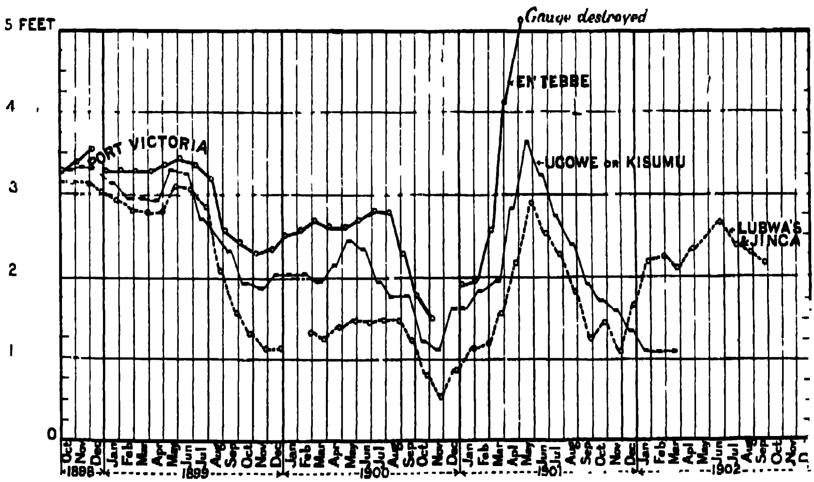


DIAGRAM OF MEAN MONTHLY LEVELS OF VICTORIA NYANZA.

of the surface of the lake have been kept at several places in the northern part of it, but these records have to be studied with care and accepted with much caution, or erroneous deductions may readily be drawn. The lake-levels which are in the Appendix * are tabulated by months only, but the readings have generally been recorded daily, as shown in the last table. During the years 1896, 1897, and until October, 1898, the three gauges at Port Alice or Entebbe in Uganda, at Port Victoria, on the Berkeley gulf in the north-east corner of the lake, and at Lubwa's near the outlet of the Victoria Nile, must be read only as recording the fluctuations in level at those places; the zeros of the three gauges were not supposed to be at the same level, nor

* I am indebted to Major (now Sir Robert) Hanbury Brown, C.M.G., Cairo, for these figures.

was the reduced level of them known. But in October, 1898,* the zeros of the gauges are said to have been adjusted to the same level, and the readings appear to show that this was really done, or, at any rate, it was approximately done. This is shown by the fact that there was very little variation in the level of the lake during that month at any of the three stations, as the "average" reading was 3 feet 3 inches at Port Alice; 3 feet 3½ inches at Port Victoria; and 3 feet 1½ inch at Lubwa's: the variation between the maximum and minimum readings of the whole month was only 1¾ inch at Port Alice, 3½ inches at Port Victoria, and 2½ inches at Lubwa's. These figures seem to prove that at that time the zeros of the gauges must have been at the same reduced level, or, at any rate, within 1 or 2 inches of it. The

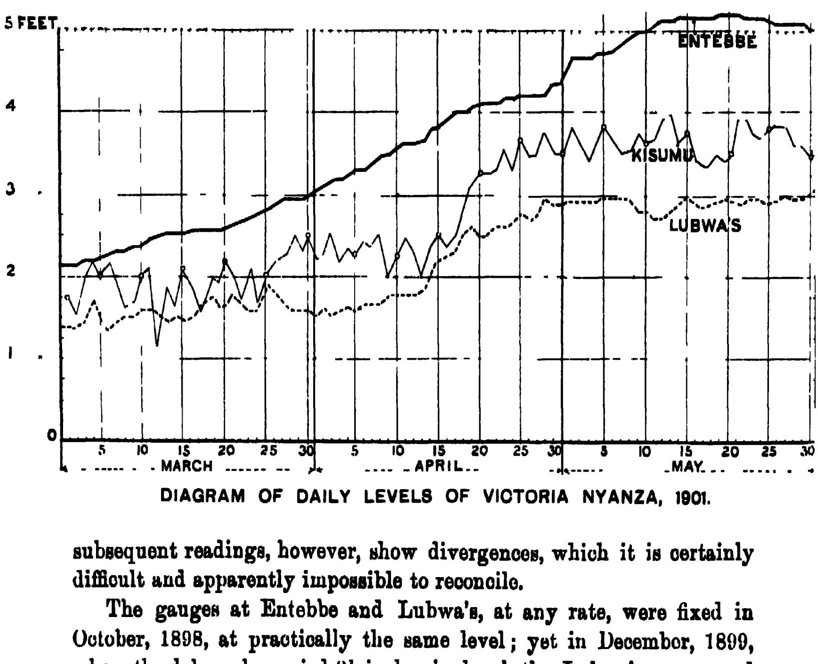


DIAGRAM OF DAILY LEVELS OF VICTORIA NYANZA, 1901.

subsequent readings, however, show divergences, which it is certainly difficult and apparently impossible to reconcile.

The gauges at Entebbe and Lubwa's, at any rate, were fixed in October, 1898, at practically the same level; yet in December, 1899, when the lake only varied 2½ inches in level, the Lubwa's gauge read 14 inches lower than the Entebbe one: in July, 1900, it was 15 inches lower, and in May, 1901, it was 27 inches lower. The last table in the Appendix shows the daily readings at three places. These are plotted in the following diagram :—

It will be seen that from March 1 to May 15, 1901, the Entebbe gauge rose 3 feet, the Kisumu gauge rose 2 feet, and the Lubwa's gauge 1 foot 7 inches. It seems impossible that these figures can be correct.

* Page 393, Report of the British Association for the Advancement of Science, 1901.

It has been suggested that the lake-level is affected by the wind. This is undoubtedly the case at Kisumu, where the gauge regularly rises and falls with the wind, and it is no doubt so, to some extent, on all places on the lake. But though the wind causes fluctuation in level, its effects cannot continue to influence the gauges steadily for long periods; during the first three days in March and about May 15 the gauges were steady, and it seems incredible that the general level of the water surface could have risen 17 inches more at one place than at another. Lubwa's is only 70 or 80 miles from Entebbe as the crow flies, and both places are on the body of the lake. It seems impossible to reconcile those discrepancies; it would appear that either the readings must be wrong, or the level of the zeros must have been changed, or the gauges must be so placed that they do not record the true level of the lake. It is greatly to be regretted that these discrepancies occur, as they throw much doubt on the records. It is most desirable that a really reliable bench-mark should be made in the neighbourhood of each gauge, and that the level of the zero should be tested from time to time. This has not been done. The Entebbe gauge was moved in 1901 to a better site, and there was a hiatus of some months in the readings. The new gauge and the old one were not connected by levelling, nor was the zero of either referred to any permanent bench-mark, so the connection between the new and old readings is lost. The local officers who deal with the gauges are busy men, and have but little time to devote to this subject. They also, perhaps, fail to appreciate the importance, so apparent to an engineer, of preserving an absolutely accurate record of the level of the datum of the gauges.

The catchment area of the lake, as taken from the maps, is about 95,000 to 100,000 square miles, including the lake itself, which is about 26,000 square miles; but the surveys, both of the lake and the surrounding countries, are, of course, imperfect. Many rivers and streams flow into the lake, but the only outlet is the Nile at the Ripon falls near Jinja. The rainfall returns show that in the northern portion of the lake the annual rainfall is from 40 to 70 inches; but over 90 inches was recorded at Mumia's in 1897. The rainfall is probably less in the southern parts, and it is generally assumed (on very imperfect data, however) that the ordinary rainfall over the catchment is about 30 inches. It is interesting to note what a small proportion of this water passes over the only escape from the lake at the Ripon falls. These falls may possibly draw off from the lake sufficient water to lower it 9 inches or a foot in the year, but evaporation and absorption must be at least six or eight times as much as this.

The Ripon falls would be better described as rapids. There is a rocky barrier of hornblende schist, like an embankment, across the channel where the Nile issues from the lake. This barrier is perhaps 10 to 12 feet above the ordinary lake-level, and would, if it were

continuous, completely close the outlet. But it is broken in three places by gaps in the barrier, and the water rushes through these like the discharge from the under-sluices of a weir. The barrier, from shore to shore, is perhaps 1200 feet long, and the three gaps in it are probably less than 300 feet, but they have never been measured. The water of the lake above the barrier is about 14 to 15 feet above that in the river below. The depth of water in the breaches through which it rushes has never been ascertained, but it probably does not average more than 6 to 8 feet; it is certainly less in places, as the rocks can be seen below the water. The discharge over the falls varies with the level of the lake.* Mr. Willcocks gives the minimum discharge of the Ripon falls as 25,000 cubic feet per second,

RIPON FALLS

and the maximum as 30,000 cubic feet; but there seems reason to think that the minimum discharge may fall as low as 15,000 cubic feet per second. But even 30,000 cubic feet per second would only draw $\frac{1}{25}$ part of an inch off the entire surface of the lake in one day, or about $1\frac{1}{4}$ inch in a month. The lake rarely falls quickly; the most rapid fall shown by the gauge-readings was in October, 1900, when a fall of 10 inches in eight days is recorded at Port Ugowe, but this is not corroborated by the other gauges, and must be received with doubt. The Lubwa's gauge in August, 1899, fell 1 foot in a month, and 11 inches in sixteen days; the Entebbe gauge, however, only fell 6 inches in the same month. To lower the lake 6 inches in a month would

* 'The Nile Reservoir Dam at Assuan,' p 18

require a constant discharge of 150,000 cubic feet per second, or five times the probable maximum discharge of the falls; to lower it 11 inches in sixteen days would need about 500,000 cubic feet per second for that time; to lower it 10 inches in eight days would require a discharge of nearly a million cubic feet per second, or about thirty times the probable discharge of the Ripon falls. It seems clear, then, that, in any case, the discharge from the Ripon falls is only a small factor in the matter. It is evaporation from the surface which is the main cause of a drop in the lake-levels. A fall of 6 inches in a month seems to be a high rate of fall for the lake generally; as the Ripon falls only take off a little more than one inch as a maximum, it follows that a high rate for evaporation and absorption would be 5 inches in a month on the supposition that there was no rainfall; but there would always be some rainfall and some flow off the catchment, probably aggregating 2 inches at least. So the *maximum* evaporation and absorption is probably not greater than 7 or 8 inches in a month, or say $\frac{1}{4}$ inch to $\frac{1}{3}$ inch a day. On the other hand, if the Lubwa's gauge is correct, and the lake really did drop 11 inches in sixteen days, it follows that the maximum loss from evaporation and absorption must be much greater. For in the sixteen days the falls would take off less than one inch from the surface of the lake, so the loss from other causes must have been more than 10 inches, or more than $\frac{5}{8}$ of an inch a day. This is highly improbable.

The maximum rise which is recorded in the lake was in 1901, when it was almost 10 inches in fifteen days. This rise may be reasonably explained as follows.

The catchment area, beyond the limits of the lake itself, is approximately three times the area of the lake. So that, if half the rainfall on this catchment flowed into the lake in any given time, the level of the lake would be raised (were there no loss) by (1) the depth of rainfall on the lake plus (2) one and a half times the depth of rainfall on the catchment beyond the lake. So a fall of 6 inches over the whole catchment in fifteen days (were there no loss) would raise the lake (1) 6 inches plus (2) 9 inches, or 15 inches in all. During the time the loss due to the Ripon falls would be about half an inch, and the evaporation and absorption might account for about $4\frac{1}{2}$ inches. So, on this hypothesis, the net rise in the lake would be 10 inches in fifteen days. The calculation depends, of course, on two main assumptions: first, that the flow off the catchment is half the rainfall; and, secondly, that a fall of 6 inches in fifteen days might occur over the entire catchment.

The available data are quite insufficient to prove whether these assumptions are correct; all that can be said is experience elsewhere shows that they are not unreasonable.

All these considerations point clearly to the conclusion that the rise and fall of the lake is mainly—almost entirely—due to climatic

considerations, and is but little affected by the draught of the Nile at the Ripon falls. Engineers who calculate on the lake as a vast storage reservoir for irrigation would do well to remember that the converse of this is true—that is, that no works they can construct will enable them to control anything but a very small percentage of the rainfall on the catchment of 100,000 square miles. Nature, not man, rules over at least nine-tenths of that rainfall; it is incessantly either falling from the skies or being drawn up to them again. It is only the residue escaping at the Ripon falls which man can deal with. This is comparatively a small amount, not greater than the *maximum* discharge of one of the great canals in Egypt.

About halfway between the coast and the great lake the Uganda railway reaches an elevation of 5000 feet above the sea, and for 250 miles or more never drops below that elevation. In this part there is a country not less than 5000, nor more than 10,000,* feet above the sea, which is rich, temperate, and in parts beautiful. It is hard to conceive that such a tract can exist in the heart of Africa, within a few miles of the equator. There are forests in parts, open plains in parts, park-like lands in parts covered with rich grass and dotted here and there with trees. This tract of country, which extends over an area of some ten or twelve thousand square miles †—say the size of England north of Liverpool and Sheffield—is almost uninhabited at present, and it offers a field for colonization by Europeans, which, so far as climate, at any rate, is concerned, seems eminently suitable. The world in East Africa says that not only this tract, but the protectorate generally, only needs irrigation to be a magnificent agricultural country. This is, however, a statement which must be received with caution; it would certainly seem to be the case that the great grassy plains which extend for many miles on the Uganda railway need nothing but water to make them as productive as the valleys of the Ganges or the Nile. But the question of the irrigation of these plains is not an easy one; it is one which obviously needs consideration and discussion, and this paper is mainly written to discuss it.

Many people who talk of the necessity of irrigation seem often to forget the elementary fact that irrigation cannot be effected without water; they, too, have frequently not even the most vague idea of the volume of water necessary to mature a crop. Rivers are, of course, the most obvious source of supply, but the rivers, in the higher lands through which the Uganda railway passes, are too insignificant and uncertain in their discharge to irrigate any large tracts of country.

There are three main rivers in the protectorate: the Juba, the Tana, and the Sabaki. The Juba river forms, for a great portion of its course,

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* Page 9 of Sir H. Johnston's Report (Africa, No. 7, 1901).

† Ibid.

the eastern boundary of the northern part of the British territory. It rises in the highlands of Abyssinia, and has a perennial discharge, which is small in the dry season, but is considerable during the two flood seasons. These occur from July to October, and again in March and April.* The Juba is navigable for about 400 miles from the sea. The Tana river rises from the snows of Mount Kenya, and in the highlands of the Kikuyu and Settim hills; it is said to be a considerable stream in its higher reaches, but to become materially reduced in volume before it reaches the sea. It is navigable for about 200 miles. The banks of this river, in its lower reaches, are cultivated † to a considerable extent, and the fields are irrigated by little canals cut from the river.

It seems probable that irrigation schemes of considerable magnitude might be possible from the Juba and the Tana, especially in the higher lands, but no reliable data are available as to the discharges of the streams or of the country which might be benefited.

The greatest interest, however, attaches to the Sabaki river and its tributaries, as they lie in the best known parts of the protectorate, in the neighbourhood of the Uganda railway where colonization, either by Europeans or by natives of India, seems not only possible, but desirable. The Sabaki river has two main tributaries, the Athi and the Tsavo. The former rises a little above Nairobi, in the Kikuyu hills, and flows in a south-easterly direction, more or less parallel with the railway, until its confluence with the Tsavo river. At Nairobi, one of the tributaries of the Athi river has a small perennial discharge, perhaps 30 cubic feet per second; but lower down, the Athi river for a great portion of the year is said to be only a series of pools, with little or no flow at all between them. The Athi is subject to occasional floods, but no data are available of their duration or volume. The Tsavo river rises in Mount Kilimanjaro, a beautiful snow-clad mountain over 19,000 feet high, which lies in German territory just beyond the boundary between British and German East Africa. It has a perennial discharge, which the engineers of the railway estimated to be about 380 cubic feet per second. There are no accurate gaugings of the river, and it is not improbable that the discharge may fall below this estimate, but, as the river is snow-fed, there must always be a considerable volume of water in it. It is the only river in this part of East Africa from which perennial irrigation, on anything but the smallest scale, is possible; the supply might be sufficient to irrigate from 30,000 to 40,000 acres of land, and it would probably be possible to get two crops a year from this area. The best plan, apparently, would be to throw a weir across the Sabaki river below its confluence with the Tsavo, and to distribute the waters of both rivers over the tract which was most easily

* Pages 27 and 28, 'Précis of Information' concerning the British East Africa Protectorate.

† Page 50 of 'Précis of Information.' 1901.

irrigable. The irrigated land would be at about an elevation of 1200 to 1400 feet above the sea, and should be suitable for sugar-cane, opium, and millet crops. The tract which would be irrigated lies within the field of action of the tsetse fly. This is a factor which must not be overlooked. It might prove difficult, or even impracticable, to cultivate where this pest holds sway.

It has been suggested that the great Tarn wilderness, which lies at an elevation varying from 600 to 1800 feet above the sea, might be irrigated, possibly from the Tsavo. This scheme does not seem feasible, and even if the waters of the river could be led on to the wilderness, the area which could be irrigated would only be a very small fraction of it.

In the tract of land which might be suitable for colonization by Europeans, lying at an elevation of more than 5000 feet above the sea, there are small hill streams. Some few of these have a small perennial discharge, but it is very small. In the 250 miles of railway which runs through these highlands there may be four or five streams, such as the Morendat, the Gilgil, and Niozo, of which the minimum discharge is 10 to 15 cubic feet per second. If this discharge were fully utilized, as it easily could be, two crops a year might be raised on a widely distributed area of say 10,000 to 12,000 acres. But what is this in a tract of 2000 or 3000 square miles? Already some small beginning has been made in irrigating lands from the small river at Nairobi (5400 feet). A little artificial channel some 8 feet broad has been made, and irrigation of potatoes and garden crops is effected. About 5 or 6 miles from Nairobi, also at the Riverside Farm, large crops of potatoes have been secured by irrigation, and all European garden produce has been successfully grown.

The hill streams, however, are not, of course, limited to their perennial discharge; they, and many others which have no perennial discharge at all, but run absolutely dry for a great portion of the year, have torrential discharges after periods of heavy rain. It would, no doubt, be possible to find among the hills many suitable sites for reservoirs in which a portion of the floods could be impounded, and this appears to be the only possible way in which any considerable area could be irrigated in the uplands of East Africa. It is doubtful whether, in places, the soil would be sufficiently retentive to hold the water, and the sites would have to be selected with care. It is improbable that these reservoirs could be on a large scale, but they would generally consist of earthen embankments across gorges, with probably a masonry escape for a by-pass. The reservoirs would be dotted about the country with probably two or three farms of a few hundred acres, each dependent on each reservoir. The reservoirs and supplementary works would vary greatly in cost according to circumstances, but this system of irrigation would be far more expensive than that of utilizing the small perennial discharge which is available in a few streams.

It has been suggested that artesian wells might produce a good supply of water. It is extremely probable that such wells would succeed in places. A boring was made in the Taru wilderness, but it was carried to a depth of 60 feet only, where it ended on granite rock and produced no water; it is now proposed to sink a well to a greater depth somewhere on the Kapiti plains. But such wells, even where they did produce water, would only give a moderate discharge; any extensive irrigation of crops from them would probably be financially impossible. But they would be invaluable on the great prairies of grass, where countless herds of cattle could be raised in luxury if water could be provided for them to drink throughout the dry season. It is improbable that these vast plains could ever be laid down in grain, as they might be if they could be irrigated, but there seems no reason why they should not be converted into farms for sheep, cattle, and poultry. The great flocks of the Masai tribe are evidence of this.

In Italy and in Baluchistan a system of irrigation is adopted which might be successful in some parts of East Africa. Tunnels are run into the hills, tapping underground streams, which are led out to the surface through the tunnels. The channels are called fontanelli in Italy, and karezes in Baluchistan; they are not difficult to construct when the circumstances are suitable and timber is cheap, but they require labour skilled in this particular kind of work, which would not be available in Africa.

It would appear, then, that the East Africa Protectorate is not, as far as can be seen from the information at present available, a country for grand irrigation projects. There may be places on the Tana and Juba rivers where large perennial canals are possible; but this is doubtful. It is a country which can be best developed, from an agricultural point of view, by utilizing to the utmost the natural rainfall, and by supplementing this by small storage works which would impound the fluctuating discharges of the streams. Such works must necessarily be scattered.

It has already been stated that the population in the East Africa Protectorate only averages about ten to twelve persons per square mile, and that there are parts of it, which are the most temperate and the most healthy, where there is hardly any population at all. There can be little doubt that, even without irrigation, the country could support a much greater number, and that, in those parts where irrigation is possible, three hundred or four hundred persons per square mile could flourish. The natives of the country are apathetic, and not given, as a rule, to agriculture. The colonization of the temperate highlands by Europeans or Eurasians, and of the lowlands by the natives of India, is a scheme which seems a promising one. It is by no means improbable that, if inducements were offered to the Indians who have constructed the Uganda railway, and if arrangements were made to

help them to bring their families to this country, a beginning might immediately be made. There are now almost eight thousand of these men in the protectorate, and among them there must be a percentage, probably a small percentage, who would remain, but they would require, and should be offered, liberal terms. No European or Eurasian colonist could settle, at present, who had not some capital at his disposal, and probably few would come until the agricultural prospects of the country were more clearly demonstrated. It would seem desirable that the government of the protectorate—

1. Should institute a model agricultural farm in some part of the highlands, and test experimentally the growth of different crops, both with and without irrigation.

2. Should investigate in the lower lands the prospects of perennial irrigation from the Juba, Tana, and Tsavo rivers.

3. Should record more systematically, and at more numerous stations than at present, the meteorological conditions.

4. Should make trial borings for artesian wells in a few places, selected by geological experts.

5. Should construct in the neighbourhood of the farm a small storage project as a model and guide to settlers.

It is quite certain that the agricultural advancement of the East Africa Protectorate must be slow. Irrigation works would be a material aid to that development, but it must not be anticipated that they will be anything more than supplementary to the natural conditions. The greater proportion of the country must necessarily be cultivated by means of the rainfall alone, and irrigation can only be practised in favoured localities which offer natural facilities. There can be no doubt that, whatever other prospects there may be before it, the country offers many advantageous agricultural conditions for the emigration both of Europeans and Indians; the construction of the Uganda railway has immensely increased the potential value of those conditions, and has advanced by many years the civilization and development of one of the most interesting countries in tropical Africa.

APPENDIX I.

LEVELS OF LAKE VICTORIA NYANZA

	Port Alice—Entebbe: Readings in feet and inches. Max.	Min	Average	Rainfall	Port Victoria: Readings in feet and inches Max	Min	Average	Rainfall	Lubwa's: Readings in feet and inches. Max	Min	Average	Rainfall
	ft in	ft in	ft in	in	ft in	ft in	ft in	in	ft in	ft in	ft in	in
1896												
January	2 0	1 9¾	1 10¾	—	3 8¼	3 5	3 7½	—	—	—	—	—
February	1 9	1 6	1 8	—	3 7	3 1½	3 4 21/31	—	2 1½	1 8	1 11	—
March	1 7	1 4	1 7½	—	3 6¼	3 0	3 3¼	—	2 0½	1 6½	1 10	—
April	1 7½	1 5½	1 6½	8 61	3 5	3 1½	3 3½	—	1 11¼	1 6	1 9½	—
May	1 7½	1 5½	1 6½	4 45	3 4½	3 3	3 3½	—	1 10¼	1 7	1 9½	—
June	1 6	1 4	1 4 23/31	3 18	3 4½	3 2	3 2 13/15	—	1 10½	1 7¼	1 8½	—
July	1 6	1 3	1 4 24/31	0 31	3 2½	2 10	3 0⅓	—	1 9	1 4	1 6⅓	—
August	1 4	1 2	1 2 5/10	4 10	3 0½	2 10	2 10⅓	—	1 6½	1 3½	1 5	—
September	1 1½	0 9	0 10 7/10	2 37	2 10	2 5	2 7	—	1 4¾	0 10½	1 2½	—
October	0 9	0 5	0 6 2/31	4 59	2 6	2 2½	2 3 9/11	—	1 1½	0 9	0 10½	—
November	1 2½	0 6	0 10 1/10	12 05	3 0½	2 4	2 8	—	1 6½	0 8	1 1⅛	—
December	1 3¼	1 0½	1 1 7/10	4 69	3 0	2 9	2 10¼	-	1 5¼	1 2	1 3¼	—
1897												
January	1 2	0 11½	1 0⅞	1 74	2 11¾	2 9	—	—	1 4½	1 2	1 3	—
February	1 2	1 0	1 1½	3 62	3 1	2 10	—	—	1 6¾	1 2¾	1 4½	—
March	1 3½	1 1½	1 2¾	3 67	3 1½	3 0	3 7/10	—	1 6¾	1 2	1 5	—
April	1 8	1 3	1 5	13 73	3 6	3 1	3 5	—	1 11	1 5	1 7½	—
May	1 10	1 8	1 8 1/10	10 55	3 6	3 0	3 3	—	1 11¼	1 7¼	1 10½	—
June	1 11½	1 8	1 10	2 18	3 8	3 3½	3 5 1/10	—	2 3¼	1 10	2 0	—
July	1 8½	1 7	1 7¼	3 69	3 5¼	3 4	3 4 9/10	—	2 0	1 7	1 10½	—
August	No records. Mutiny								No records.			
September												
October												
November												
December												

LEVELS OF LAKE VICTORIA NYANZA.

	Port Alice—Entebbe. Readings in feet and inches. Max. ft	in.	Min. ft	in	Average ft	in	Rainfall in	Port Victoria Readings in feet and inches Max ft	in	Min ft	in	Average ft	in	Rainfall in.	Lubwa's Readings in feet and inches Max ft	in	Min ft	in	Average ft.	in	Rainfall in
1898.																					
January														—							—
February							—							—							—
March							—							—							—
April	No records		Mutiny.				6 93	No records						—							—
May							6 08							—	2	1	1	9	1	11¾	—
June							4 29							—	1	9	1	7	1	3¼	—
July							0 65							—	1	10½	1	8	1	9¼	—
August							4·47							—	1	9	1	7	1	8 7/31	—
September	2	4¼	2	4	2	4 9/10	5 62	3	4	3	2	3	3	—	1	9¼	1	6¼	1	7½	—
	Datum changed *														‡		‡		‡		
October	3	3¾	3	2	3	3	4 53	3	5	3	1½	3	3 1/7	—	3	2½	3	0	3	1½	—
November	3	6½	3	1¾	3	4⅝	7 64	3	5½	3	1½	3	3½	—	3	2½	3	0	3	1¼	—
December	3	8	3	4¾	3	6⅙	1·63	3	6	3	1	3	3	—	3	3	2	10¼	3	0½	—
1899																					
January	3	4½	3	3	3	3	0 61	3	3	2	11½	3	1¼	—	3	1½	2	11	2	11½	—
February	3	7	3	2	3	3	3 46	3	1¼	2	10	2	11 7/10	—	3	0	2	9	2	10	—
March	3	4½	3	1¼	3	3	3 45	3	1½	2	9	2	11½	1 03	2	11	2	8½	2	9¾	—
April	3	6	3	1	3	3	9·15	3	2	2	7½	2	10 11/17	3 38	3	1	2	8½	2	9¼	—
May	3	7	3	3½	3	4	8 56	3	7	2	10	3	3⅔	4 85	3	5¼	2	9½	3	1	—
June	3	6½	3	4¼	3	5	3 02	3	6	3	0	3	2⅚	2 55	3	4	2	10	3	0¼	—
July	3	6½	3	2½	3	4	2 32	3	1	2	4½	2	8½	0 20	3	0	2	7	2	10	—
								Port Ugowe †													
August	3	3½	2	9½	3	2	1 36	records		incomplete.				1 19	2	9½	1	10	2	1	—
September	2	9½	2	4½	2	6½	0 64	2	9½	1	11	2	3 11/30	2·68	1	9	1	5	1	7	—
October	2	6½	2	5	2	4½	No record.	2	2	1	8	1	11 7/31	2 91	1	5	1	1	1	3½	—
November	2	4½	2	2½	2	3		2	2	1	7	1	10 23/30	5 48	1	2	1	1	1	1¼	—
December	2	5½	2	3	2	3½		2	8½	1	6½	2	0 1/31	3·93	1	3	1	1	1	1¼	—

* Datum was, apparently, depressed about 8 inches.
† Port Ugowe is a new post which has been established on the lake in the place of Port Victoria abolished It is the same place as Kisumu
‡ Zero of gauge was depressed about 1 foot 6 inches or 1 foot 7 inches

	Port Alice Entebbe				Port Ugowe				Lubwa's				Port Florence			
	Readings in feet and inches			Rainfall	Readings in feet and inches			Rainfall	Readings in feet and inches			Rainfall	Readings in feet and inches			Rainfall.
	Max	Min	Average		Max	Min	Average		Max	Min	Average		Max	Min	Average	
	ft in	ft in.	ft in	in.	ft in	ft in	ft in	in	ft. in	ft in	ft in.	in	ft in	ft in	ft in	in
1900.																
January ...	2 6½	2 5½	2 5	2 26	2 5	1 10	2 0$\frac{1}{31}$	5 18	—	—	—		2 5	1 10	2 0½	5 18
February ...	2 7½	2 6½	2 5$\frac{9}{10}$	4 23	2 4	1 8	2 0$\frac{2}{10}$	6 45	1 5	1 1	1 4	—	2 2½	1 8	2 0⅓	6·45
March	2 8	2 7	2 7½	6 10	2 7	1 6	1 11$\frac{20}{31}$	4 65	1 5	1 1	1 3	—	2 7	1 6	1 11½	4 65
April	2 7	2 7	2 7	13·74	2 4½	1 9	2 1$\frac{7}{15}$	5 04	1 7	1 3	1 4¾	—	2 4½	1 9	2 1½	5·04
May	2 8	2 7	2 7	2 70	2 9	2 1	2 4$\frac{2}{5}$	1 88	1 7	1 4½	1 5¾	—	2 9	2 1	2 4½	1 88
June	2 9½	2 8	2 8	5 82	2 7	2 0	2 3$\frac{3}{15}$	2 26	1 6½	1 4	1 5½	—	2 7	2 0	2 3⅔	2 86
July	2 10½	2 9½	2 9	0 43	2 3	1 6	1 11$\frac{17}{31}$	0 05	1 6	1 5½	1 5¼	—	2 3	1 6	1 11⅔	1 56
August	2 10	2 8	2 9	2 91	2 0	1 6	1 9$\frac{12}{31}$	2 70	1 6	1 5	1 5¼	—	2 0	1 6	1 9⅓	2 70
September ...	2 7½	2 1	2 3	3 43	2 2	1 6	1 9$\frac{3}{15}$	3·66	1 5	1 0	1 3	—	2 2	1 6	1 9⅓	3 68
October ...	2 0	1 7	1 9	1 53	1 8	0 11	1 2$\frac{1}{31}$	2 89	1 0	0 6½	0 9¼	—	1 8	0 11	1 2	2 89
November ..	1 7	1 5	1 5⅓	5 99	1 6	0 6	1 1$\frac{16}{25}$	6·27	0 7½	0 4½	0 6¼	—	1 4	0 6	1 1	0 27
					Kisumu.*											
December ...	not recorded.			12 51	2 0	1 4	1 7$\frac{10}{31}$	2·15	1 3	0 6	0 10	—	2 0½	1 0	1 1⅓	6 23
1901.																
January ...	2 0	1 9½	1 11	3 88	2 0	1 4	1 7$\frac{11}{31}$	2 15	1 4	0 11	1 1½	—	—	—	—	—
February ...	2 1½	1 11	1 11½	4 11	2 2	1 1	1 9$\frac{2}{7}$	9 36	1 3	1 0	1 2	—	—	—	—	—
March	3 1	2 1½	2 6½	4·33	2 6	1 1	1 11$\frac{14}{31}$	7 66	1 11	1 4½	1 7	—	—	—	—	-
April	4 4½	3 2	4 2½	8 40	3 9	2 0	2 9$\frac{21}{25}$	10·75	2 11	1 6	2 2	—	—	—	—	—
May	5 2½	4 8	5 2	7 94	4 0	3 4	3 7$\frac{27}{31}$	3 85	3 1½	2 8	2 10¾	—	—	—	—	—
June	—	—	—	5 57	3 11½	3 0	3 3	2 10	3 0½	2 5	2 6	—	—	—	—	—
July	—	—	—	4 01	3 4	2 5	2 8$\frac{22}{31}$	1·93	2 6	2 0½	2 2½	—	—	—	—	—
August	—	—	—	0·18	2 8	2 0	2 4$\frac{21}{31}$	0 35	2 1	1 6	1 10½	—	—	—	—	—
September ...	—	—	—	0 66	2 1	1 8	1 11⅓	0 61	1 8	0 10½	1 3	—	—		—	—
									Jinja †							
October ...	Gauge moved.	New datum		1 94	1 10	1 7	1 8$\frac{22}{31}$	0 07	1 8	1 1	1 5½	—	—	—	—	—
November ...	3 9½	3 7½	—	2 28	1 8½	1 6	1 7$\frac{24}{30}$	6 08	1 2	0 11½	1 1$\frac{1}{15}$	—	—	—	—	—
December ...	3 9	3 6	—	3 72	1 7	1 2	1 4$\frac{5}{31}$	3 06	2 2	1 3	1 7$\frac{7}{10}$	—	—	—	—	—
1902.																
January ...	3 8¼	3 5	3 6$\frac{1}{10}$	—	1 3	1 1	1 1$\frac{6}{31}$	—	2 2¼	2 0¼	2 1⅓	—	—	—	—	—
February ...	3 6	3 8½	3 4⅓	—	1 1½	1 0½	1 1	—	2 4	2 1	2 2$\frac{1}{7}$	—	—	—	—	—
March	3 8	3 4½	3 5⅓	—	1 2	1 0½	1 0$\frac{27}{31}$	—	2 3	2 1	2 1⅓	—	—	—	—	—
April	3 8½	3 3	3 6	—	—	—	—	—	2 4½	2 2½	2 3⅓	—	—	—	—	—
May	—	—	3 11	—	—	—	—	—	—	—	—	—	0 10	0 3½	0 6½	—
June	—	—	3 9½	—	—	—	—	—	—	—	2 6½		1 0½	0 4	0 9	—
July	—	—	3 7½	—	—	—	—	—	—	—	2 4¼	—	1 2½	0 8	0 10½	-
August	—	—	3 6	—	—	—	—	—	—	—	2 3¼	—	1 3½	0 6	0 11⅓	—
September ...	—	—	3 4½	—	—	—	—	—	—	—	2 2½	—	—	—	—	—

* Kisumu is the village on the gulf which was formerly called Ugowe. The site of the gauge was not altered.

† Jinja is a different site to Lubwa's and about 10 or 12 miles from it. Jinja is close to the Ripon falls.

DAILY READINGS OF GAUGES ON LAKE VICTORIA NYANZA.

MARCH, 1901.

Date	Entebbe ft.	Entebbe in.	Kisumu ft	Kisumu in	Lubwa's ft	Lubwa's in
1	2	1½	1	9	1	4½
2	2	1½	1	6	1	4½
3	2	2	1	11	1	5
4	2	2	2	2	1	9
5	2	2½	2	0	1	5
6	2	3	2	2	1	4½
7	2	3½	1	11	1	5½
8	2	3½	1	7	1	6
9	2	4	1	8	1	6
10	2	4	1	11½	1	7
11	2	5	2	1	1	7
12	2	5½	1	1	1	6
13	2	6	1	10½	1	5½
14	2	6	1	8	1	6
15	2	6	2	1	1	5½
16	2	6½	1	11	1	6
17	2	6½	1	7	1	8
18	2	6½	2	0	1	9
19	2	6½	1	11	1	7½
20	2	7	2	2	1	8
21	2	7½	2	0	1	9
22	2	8	1	8	1	8
23	2	8½	2	1	1	7
24	2	9	1	8	1	7
25	2	9½	2	0	1	11
26	2	10½	2	2	1	9½
27	2	11	2	3	1	8
28	2	11	2	6	1	7
29	2	11	2	3	1	7
30	3	0	2	6	1	7
31	3	1	2	2	1	6½

APRIL, 1901

Date	Entebbe ft	Entebbe in	Kisumu ft	Kisumu in	Lubwa's ft.	Lubwa's in
1	3	2	2	3	1	7½
2	3	2½	2	6	1	6
3	3	2½	2	2	1	7
4	3	3	2	4	1	7½
5	3	3	2	3	1	7
6	3	3½	2	5	1	8
7	3	4½	2	4	1	8
8	3	5½	2	6	1	8
9	3	6	2	0	1	9
10	3	7	2	3	1	9
11	3	7½	2	6	1	9
12	3	7½	2	3	1	9
13	3	8	2	0	1	9½
14	3	9½	2	4	2	1
15	3	10	2	6	2	2
16	3	11	2	4	2	3
17	4	0	2	6	2	3½
18	4	0	2	9½	2	6
19	4	1	3	1½	2	7
20	4	1½	3	3	2	6
21	4	1½	3	3	2	6
22	4	1½	3	3½	2	7
23	4	2	3	6½	2	7
24	4	2	3	3	2	8
25	4	2½	3	8	2	9
26	4	2½	3	6	2	8
27	4	2½	3	6	2	9
28	4	2½	3	9	2	11
29	4	4	3	6	2	10
30	4	4½	3	6	2	10

MAY, 1901

Date.	Entebbe. ft	Entebbe. in.	Kisumu. ft	Kisumu. in.	Lubwa's ft	Lubwa's in
1	4	8	3	10	2	11
2	4	8	3	8	2	11
3	4	8	3	5	2	11
4	4	8½	3	8	2	11
5	4	8½	3	10	2	11½
6	4	9	3	8	2	11½
7	4	10	3	6	2	11½
8	4	11	3	6½	2	11½
9	5	0	3	9	2	9
10	5	0	3	7½	2	9
11	5	0	3	8	2	8
12	5	1	3	11	2	8
13	5	1	4	0	2	9
14	5	2	3	7	2	10
15	5	2	3	9	2	11½
16	5	2	3	4½	2	11
17	5	2	3	4	2	10
18	5	2	3	6	2	10½
19	5	2½	3	5	2	11
20	5	2½	3	6	2	11
21	5	2½	3	11	2	10½
22	5	2	3	11	2	11½
23	5	2	3	9	2	11½
24	5	2	3	8	2	11
25	5	1½	3	9	2	11
26	5	1	3	10	2	11½
27	5	1	3	10	3	0
28	5	1	3	7	2	11½
29	5	1	3	7	2	11½
30	5	0	3	5½	3	0
31	5	0	3	8	3	1½

From March 1 to May 15—

Entebbe gauge rises		3 ft. 0 in
Kisumu	,,	2 ft. 0 in
Lubwa's	,,	1 ft. 7 in.

From April 1 to 30 (30 days)—

Entebbe gauge rises		1 ft. 2 in
Kisumu	,,	1 ft. 3 in
Lubwa's	,,	1 ft 4 in.

From April 30 to May 22 (22 days)—

Entebbe gauge rises		0 ft 10 in.
Kisumu	,,	0 ft. 5 in.
Lubwa's	,,	0 ft. 2 in.

From April 27 to May 1 (4 days)—

Entebbe gauge rises		0 ft. 5¼ in.
Kisumu	,,	0 ft 4 in.
Lubwa's	,,	0 ft. 2 in.

From about April 15 to about May 1 (15 days)—

Entebbe gauge rises		0 ft 10 in
Kisumu	,, (about)	0 ft 15 in.
Lubwa's	,,	0 ft. 9 in.

APPENDIX II.

RAINFALL. EAST AFRICA.

		Approx. average rainfall in inches.	
Coast—			
Kismayu		14·9	Average say 36
Malindi	average 40·0	38·3	
Lamu		28·9	
Takaungu		40·4	
Mombasa		44·0	
Chuyu, Shimoni (Wanga)		50·0	
Inland—			
Kibwezi		25·7	say 36
Machako's		34·0	
Fort Smith (Kikuyu)		44·6	
Munia's (Kavirondo)		67·8	say 60
Nairobi		say 40·0	
Uganda—			
Entebbe		(?) say 50·0	

For details see "Annual Rainfall in British Africa in Inches" (p. 395 of *Report of the British Association*, 1901).

Before the reading of the paper, the CHAIRMAN (Colonel G. E. CHURCH) said: I now have pleasure in presenting Mr. Buckley, who will favour us with his paper on "Colonization and Irrigation in the East Africa Protectorate."

After the reading of the paper, the following discussion took place:—

Sir FRANCIS O'CALLAGHAN: I was fortunate in being in East Africa at the time the author of the paper just read was on his tour, and still more fortunate in having had the advantage of his company on the journey between Nairobi and Uganda proper, including the visit to the Ripon falls and the return across the lake to Port Florence. The author has touched but lightly on the question of colonization, but this question is of supreme importance to the future of East Africa. He mentions that the country might be peopled with surplus population from India. In this opinion I fully concur, and, moreover, that it is the only feasible plan for ensuring an industrious population, and for the supply of labourers for such portions of the country as may be suitable for white settlers. No matter how good the climate, white men will not do manual labour where they are surrounded by inferior black races. The difficulties now encountered in South Africa exemplify this fact. Until the vast regions still available in Canada, South Africa, and Australia have been filled, it seems unlikely that tropical Africa will attract white settlers except as planters or traders. The importation of Indians will, to begin with, be costly, as whole families must be brought over at the expense of the State, and supplied with food and shelter until they have time to clear and cultivate sufficient land for their own maintenance. The natives of East Africa, so far as the experience of the railway constructors go, are essentially lazy and incapable of sustained labour. So long as they can grow sufficient food to support life, they will not work continuously. When they find a dead animal they eat it raw, tearing off the flesh like wild beasts.

The soil for the most part in the districts traversed by the railway is rich, but very porous, hence rain falling on it rapidly disappears. The rainfall of one year compared with another seems very irregular, some being very dry, and others wet. The year previous to the author's visit was, as regards the district between the Great Rift valley and the lake, an exceptionally dry one, while since that visit in

April last there have not been three consecutive dry weeks, and only on two occasions have two weeks in succession been without rain. Shortly before the visit of the Secretary of State for the Colonies there was a downpour extending over a considerable area in this district, which exceeded an average of 1 inch per hour for four hours, doing much damage to the railway works. Had it not been for this damage it might have been possible to have taken Mr. Chamberlain's party right up to the lake, but his time being limited, no risk of detention could be taken.

The potato trade mentioned is making fair progress, the exports to Zanzibar and to South African ports being steady, and as much as 60 tons has been exported in a month. An export trade in beans, which promises well, has also arisen.

Regarding the author's remarks on the prospects of irrigation, it would be an impertinence for any one not himself an expert in this branch of engineering to criticize even favourably the opinions of one of the leading irrigation experts of India.

Sir Harry Johnston: I have not anything of very great importance to add to the interesting and instructive paper to which we have listened; in fact, I came here more to be informed than to offer any information. But I may perhaps add a few words about the subject of the gauges and the attempts to ascertain the varying levels of the Victoria Nyanza, and perhaps a few additional words about the Nandi plateau. I think one reason why there is such a remarkable divergence in the records of the levels of the lake is, that perhaps those of us who in the earlier days fixed the places where these levels were to be ascertained chose unwisely. Of course we thought, to begin with, of places which were safe and where we had European agents established; but Lubwa's, I should think, is not a good spot at which to get accurate levels of the Victoria Nyanza, for already there is a discernible current trending away to the Ripon falls and the discharge of the Nile, and this possibly may influence to a slight extent the level of the lake at Lubwa's compared with the level at Entebbe and some other points. I should be disposed to suggest, if we wished to get the general level of the Victoria Nyanza, the best way would be to obtain those records from some of the islands that fringe the northern shore, where the level of the water would be more generally distributed, and not so much driven up into narrow gulfs or affected by the outfall of the Nile at the Ripon falls. There is no doubt the effect of the wind on the Victoria Nyanza is very remarkable. At some seasons of the year it seems to establish—for the wind is not uniform—it seems to establish something like a regular tide, with an average foot rise and fall at the head of the narrow gulfs. Mr. Fowler, who is at the head of the Uganda Marine, and who has known the Victoria Nyanza now for several years, is of opinion that the effect of the wind is to establish a certain rocking of the lake, a certain uniform rise and fall, especially in the gulfs and estuaries, which are the places up to the present where most of these stations for recording the rise and fall have been established. Then another point that is interesting as regards the Victoria Nyanza is the discernible current right across the lake from the mouth of the Kagera (the most important affluent to the Victoria Nyanza), right across into Napoleon gulf, and so out at the Nile. It really looks as if the Kagera was the ultimate source of the Victoria Nile. Another interesting point for investigation, as our knowledge of Africa increases, is that the Victoria Nyanza seems to be a basin with a narrow rim all round. Perhaps it may be found that the structure of the rocks along the northern coast is such that it is possible for the waters to filter away through the rocks. Although there is only one ostensible outlet, yet you will find many streams rise within a few miles of Victoria Nyanza—rise from the rim and flow northwards to feed the Nile. When Captain Speke first traversed those regions, he actually believed and recorded on

his map that the Victoria Nyanza had four outlets. But, as a matter of fact, there is only one actual outlet; yet within a few miles of the waters of the Victoria Nyanza, from the slope of those hills or downs which rise to a height of about 1000 feet above the level of the lake, from their northern slope, pour away those marshy streams. Then again, on the south shore, it has been remarked how very near to the waters of the Victoria Nyanza rise the streams which flow into Lake Tanganyika. Again, all this considerable tract of country to the south of the lake is much below the level of the Victoria Nyanza. Here, again, we seem to have a very narrow rim of land that is but a little higher than the level of the Victoria Nyanza, and not very much higher than the lower country beyond the lake's basin; but it is quite conceivable that, by some slight change in the surface of the land here, the waters of the Victoria Nyanza might flood all Unyamwezi and drain away through the Congo basin to Tanganyika. Mr. Fowler, who has studied the Victoria Nyanza more perhaps than any other European, is of opinion that it is a remarkably shallow lake compared with Tanganyika. He went to the middle of the lake, and the deepest soundings were only 240 feet, which is comparatively trivial compared with Tanganyika. I might say a word of the very important province Kisumu (the Nandi plateau), which was not alluded to directly by Sir Francis O'Callaghan. If the Uganda Railway needed any justification as apart from a means of reaching Uganda, it would receive that justification in this tract of country, which is the most valuable part of the whole East Africa Protectorate. Here there are abundant streams of water; here you have in many parts no inhabitants at all, in any case fewer inhabitants than in the sparsely populated country round Nairobi. The land is more elevated, covered with rich grasses, and is entirely free from the tsetse fly, and I think is most obviously suited for the settlement of white people. No doubt, between the Rift valley and the coast there are many tracts which could be colonized by Indians.

Mr. T. E. Fuller (Agent-General for Cape Colony): I did not at all expect to be called upon this evening, and I have certainly no information whatever to add to the very interesting address which we have heard to-night, particularly from Mr. Buckley. I have been extremely interested in what I have heard, and been reminded of this fact: that the problems we have had discussed to-night are really the problems of all South Africa—I mean the irrigation problem; the great problem how to turn comparative desert, in which there may be various elevations, various descriptions of climate and population, into habitable country; and it has been my pleasure to talk to Mr. Buckley about our own problems in Cape Colony, and now in the Free State, and in the Transvaal, and they are very similar indeed to these problems which we have had described to-night. It may not be known, perhaps, to all that really there is no certain cultivation—I was going to say, south of the Zambezi—except just on the fringe of the coast, without irrigation. In the Transvaal, it is true, there are parts of the country where you may, to a considerable extent, reckon on rainfall; but taking it generally, apart from the fringe of the coast, you need the engineer to store your water, and bring the various tributary streams from the mountains. At the foot of the mountains the Dutch build their homesteads, so as to be near the watershed. I have been extremely interested in irrigation. Let me say there was no one more warmly interested in the whole of South Africa, more profoundly interested, than Mr. Cecil Rhodes. I had the pleasure of being a neighbour, a friend, a political and social friend, of Mr. Rhodes' for many years, and if we got a little dull over politics—for we frequently met—we used to lead him to the map of Africa; for he knew every part from north to south, and his table was one of the most interesting meeting-places, people from the interior constantly coming in with their little quota of information. There

are other problems, political problems, but we have all to learn that for the real advancement of the country, the material and physical problems are of far greater importance.

Captain R. Crawshay: I do not know that I can add anything to the weighty paper now under discussion, unless it be a few words on Kikuyu, a district to which Mr. Buckley has made passing allusion. What he has said in its praise I can more than endorse, after a three years' residence there off and on. It is indeed a beautiful country, with a climate as healthy and pleasant as any man's heart can desire. It is primæval forest highlands lying at altitudes varying between 4500 feet and the regions of perpetual snow on Mount Kenya—or Kilinyatha, to give its native name—18,600 feet. As far as my experience goes, no malaria is present above 7000 feet. There are everywhere plenty of clear, cold perennial streams, also two rainy seasons, producing a regular rainfall similar to that of the west of Ireland. There is, therefore, no need of that irrigation which would be necessary to develop the Ikamba plains. Anything will grow—except such fruits and vegetables as thrive only in the extreme heat of the low enervating coast. But having said this, the practical question has to be considered, "Where will be the market for produce so raised?" If this problem can be satisfactorily solved, Kikuyu offers a promising and delightfully novel field for colonization by whites, with three advantages at least over South Africa. There is timber in abundance, giant timber, fit not only for local use, but probably destined in the future, like the forests of Western Australia, to supply the wants of other countries across the seas. There is everywhere ample water. There is a good supply of native labour in the Akikuyu—fine, strong, healthy men, whom I have always found willing to work provided they are considerately treated and not too heavily tasked at the commencement.

Colonel Church: Mr. Buckley's paper is of immense practical importance. We discover countries, we explore them, we make our maps, we give a lecture, and we tell the world what we have found; but Mr. Buckley comes here this evening and tells us what we can do with what we have found, and how it may be adapted to the wants of civilization. But there is one thing, I think, that has not quite been told us, and that is, how are we going to get the white man to work alongside the negro? That is the great problem which the world has been trying to solve for very many centuries unsuccessfully. Whether it can be done in East Africa or not may depend upon the genius which is brought to bear upon the administration of the Protectorate. We are told here by Sir Francis O'Callaghan that the negro "will not work." Well, in that respect he is a great deal like the white man—he won't work unless he is obliged to. With reference to the Victoria Nyanza, we have heard much of value. If the evaporation is as great as Mr. Buckley indicates, but with reservations, it is a matter to be taken into consideration; but if, on the contrary, as Sir Harry Johnston says, the water may possibly be drawn off towards Tanganyika, or may water the country to the east of Tanganyika, then the ideas which have been expounded regarding this evaporation have to be somewhat changed. In fact, here is a problem of interest, not only to Africa, but to any country containing large lakes where the evaporation is so great as it is in the equatorial regions. The railway work we have heard described is not only a credit to engineering science, but a proof that English energy leads civilization by the hand. Mr. Buckley touches upon the great problem of irrigation. The turning of many rivulets upon a thirsty soil has made powerful nations; the irrigated *vegas* of Spain were the true sources of the glory of its Moorish kingdom for 750 years; the vast belt of arid country extending from the eastern Mediterranean sea across Anatolia, Syria, ancient

Persia, and into north-eastern India, has witnessed the rise and decay of many an empire, the grandeur of which has been due to the little threads of water which have trickled over its lands guided by the hands of the husbandman. The human race appears to seek such arid districts by preference, and this has been so from the earliest times, as is attested by the ruined cities of Central Asia. The Peruvian neglected the fertile lands of the Amazon valley slope for the arid lofty plateaux of the Andes. Similarly, the Mexicans shunned the tropical districts for the dry tablelands, which, by irrigation, they made the basis of a state which reached the highest status of barbarism found in any country of the New World by the Spanish conquerors. To-day the United States has adopted a plan for irrigating its arid lands on a vast scale, and is applying a fund of several millions of dollars yearly to the work with immense beneficial results. In California, from 10 to 20 acres of irrigated land are now considered as the equivalent of 160 not thus treated.

Would it not be wise to give the native population of East Africa a few object-lessons in irrigation? Perhaps the judicious application of £100,000 would do this with great resultant benefit to the railway and to all concerned. I think it only remains for me to thank Mr. Buckley for his extremely interesting paper, knowing that in doing so I only express your wishes.

GEOGRAPHICAL DISTRIBUTION OF VEGETATION IN YORKSHIRE.

By Dr WILLIAM G. SMITH, Yorkshire College, Leeds, and C E. MOSS, B.Sc.

INTRODUCTION.

THE two maps * and accompanying text, here submitted, are the results of a survey of the vegetation in the West Riding of Yorkshire, conducted on principles which have not previously been employed in England. The work was begun in 1898, in order to test in Yorkshire the method of botanical survey which the late Robert Smith was at that time developing in Scotland. On the completion in 1900 of the first maps of the Scottish Botanical Survey Edinburgh and North Perthshire (1900) †—it became evident that the method gave good results; and the survey of the West Riding was then systematically undertaken as opportunity offered. The first results of the experiment, maps covering over 1700 square miles and a summary of observations, are now submitted. It is considered most convenient to publish these in two parts, the first including the south-western district of the West Riding, the second including the north-east part of the Riding. In the first part Mr. Moss's work is incorporated, Mr. Rankin's in the

* The second paper and map will probably be published in June.

† The numbers in brackets after an author's name indicate the year in which a book or paper was published. The titles of the works referred to will be found in the List of References at the end of this paper. The authors' names are arranged alphabetically, and the papers of each author in chronological order, with the year-number in brackets. In the case of a periodical, the number in brackets is the year of publication of the paper referred to

second part, although their observations have by no means been strictly confined to these areas. The survey has been carried beyond the limits of the present maps, and practically all the West Riding, with parts of the North Riding, are completed. It is, however, advisable to keep the maps uniform in size, and to issue them as a series, so that the work done beyond the present limits will appear later.

The principles of the method have already been explained elsewhere, but a brief summary will probably be useful. The vegetation of any area may be considered from two aspects, distinct yet closely related. One may set out to find an answer to the question, "What species occur here?" or to solve "How are the species arranged with regard to one another, and with regard to soil and climate?" The result in the former case would be a flora; in the latter it would be a connected account of the vegetation. The floristic method has as its first object the recording of all the species found in an area; these, arranged under genera and natural orders, with notes on habitat and frequency or rarity, would constitute the flora of the district. The present and past distribution of the species or genera over the Earth, and the history and migration of the race, are wider questions of floristic interest. The botanical characters of most importance here are those of the race, especially the floral organs. The production of floristic maps in Britain was begun by H. C. Watson (1843); these showed the areas of distribution of species or genera.

The study of vegetation, on the other hand, recognizes that there is a close connection between the plants of a country or other area, and the prevailing conditions of soil and climate. Thus the vegetation of a dry district is distinct from that of a rainy one; or, in a narrower sense, the vegetation of an upland pasture is different from that of a lowland marsh. In the floristic sense, the plants growing together under uniform conditions of soil and climate may have no kinship; yet the fact that they grow together indicates an œcological relationship. From this aspect, "the essential characters of the species are those indicating adaptation to the environment, and are to be found mainly in the vegetative organs" (Smith, R., 1899). After some experience in examining vegetation, the recognition of biological communities or societies is acquired. However large or small the number of species included in such a plant-society may be, it is possible to arrange them under three subdivisions. (1) Dominant social forms: one or more species, whose presence is in the first place determined by conditions of climate, soil, and environment suited to their requirements; while their dominance is the result of gregarious or social habit. Thus heather and grasses are dominant social forms, while trees, also social, obtain an additional advantage from size and age. (2) Secondary or subordinate social forms struggling for dominance. (3) Dependent species

protected by the dominant forms, or living in the humus beneath them. The scope of such a plant-society may be wide or narrow, according to the selection of dominant forms. For example, heather, grasses, oak, and pine are four dominant social forms characteristic of groups which are wide and inclusive. These may be designated types of vegetation. Within a heather moor smaller communities exist where *Calluna*, *Erica Tetralix*, or *Juncus* are characteristic of more or less limited spheres dependent upon local conditions of soil and water-supply. These are narrower in their scope, and may be called plant-associations. In describing any region the selection of associations or types depends largely on how detailed a survey is attempted.

The plan followed in the present survey is largely founded on the work of Prof. Flahault, of Montpellier, who is carrying out a survey of the vegetation of France based on the distribution of certain trees (1897). A number of trees are social, and tend to form forests where one or two species prevail and more or less completely exclude all others. From a geographical point of view, forests of a particular tree indicate certain climatic and soil conditions; from a botanical point of view, the presence of particular associations of subordinate species; and from an economic point of view, regions suitably situated for the growth of certain cultivated species and for certain industries. The botanical survey of Scotland was a direct outcome of Flahault's work; for R. Smith, while a student at Montpellier, accompanied him on excursions. Flahault's method of representing the vegetation by recording the distribution of selected forest trees on a map was at first proposed in Scotland; but R. Smith decided that this would give an inadequate, if not erroneous, impression of the plant-covering of the country. The almost total absence of primitive forest in Britain and the great proportion of cultivated land have so changed the original and natural vegetation of the country, that a map according to Flahault must be to a great extent hypothetical. R. Smith then decided that a statistical map of the vegetation was first necessary as a basis in preparing either forest maps or maps showing the plant associations. A scheme of types of vegetation was drawn up; and the results already published (1900), as well as unpublished, show that the method will do much to assist towards a clearer conception of the vegetation of Britain. The same principles have been applied in Yorkshire.

Detailed maps of vegetation representing natural subdivisions of North America are constructed by the staff of the U.S.A. Department of Agriculture (1898). In the series of monographs edited by Engler and Drude (1897), vegetation maps are also issued, but the scale used is much smaller than in our case. Maps of isolated forest areas, with the dominant trees indicated by colouring, have also been prepared for many parts of France, Germany, and Russia, but none of them attempt a continuous area.

The general programme of a vegetation survey was discussed by R. Smith (1900). The chief points to be considered may be summarized as follows:—

(*a*) The chief zones or regions, characterized by definite plant associations, into which the district may be most conveniently divided.

(*b*) The particular conditions of soil and atmosphere which distinguish each zone or region.

(*c*) The adaptations of the plant-species to their environment.

(*d*) The relations existing between the species—that is, which species are dominant, which subdominant, and which dependent upon the dominant species for shelter or for food.

(*e*) The influence of animals and of man upon the associations.

(*f*) The general conditions of climate and of vegetation in the district compared with those in other districts.

The method of survey is to traverse the selected area till its prominent associations are recognized. The extent of country observed in a single excursion is variable, and depends on whether the vegetation is uniform and easily accessible, or the contrary. It may be necessary to traverse a difficult area at distances of a few hundred yards: but the routes may be farther apart where the vegetation seen from a distance is found to be uniform. Opportunities of checking previous observations occur when a place already visited is seen from another vantage, or when two routes cross, as they frequently do. In preparing the maps, the limits of prominent associations are ascertained and recorded on the field-map on the spot. The maps used for outdoor work are generally the "1-inch" sheets of the Ordnance Survey, although in some cases the "6-inch-to-mile" sheets are preferable. The published maps are on the scale of 1-inch to 2 miles; a convenient size for publication with a small number of types of vegetation. The number of types on the published maps does not, however, represent all those recognized in field-work, but they are taken as sufficient to effect a primary analysis of the vegetation. A less apparent but more important work is to collect information regarding associations. When an association is recognized, the plants found there are recorded in a field notebook, with the order of their occurrence as dominant, secondary, or dependent species, also their state of flowering. Other observations are made regarding subjacent rocks or deposits, conditions of drainage, altitude, exposure, and environment generally. The records thus obtained are important not only as information about the vegetation and its local conditions, but also as standards for comparison. One type of vegetation has to be compared with another quite distinct in character; or it frequently happens that an association as developed in one place has to be compared with another somewhat similar, but in a different locality. It is only by careful notes that one overcomes the difficulty of carrying on the survey during a series of

excursions extending through two or three years. The field-notes are also invaluable when one observer wishes to compare results with another.

The maps are prepared entirely from our own observations; but in the preparation of the paper the existing literature on the vegetation of the West Riding has not been ignored. The 'Flora of West Yorkshire' (F. A. Lees, 1888) and 'North Yorkshire' (J. G. Baker, 1885) are indispensable in considering the plant geography of the county. In both these works, Thurmann's (1849) attempt to classify vegetation according to the mechanical constitution of the underlying rock has been adapted to Yorkshire; and lists of characteristic species given. 'West Yorkshire' (Davis and Lees, 1880) has also been referred to, especially for the lists of plants of definite localities, which have been useful guides, although not arranged according to the principles followed in this survey. In matters relating to the geology of the area we are indebted to Mr. P. F. Kendall, of Yorkshire College, in a degree which is beyond formal acknowledgment. The introduction to Mr. Crump's 'Flora of Halifax' (1901) has proved of great service, because it follows the lines of our work. Other sources of information are Mr. Rothery's 'Flora of Skipton,' and the publications of the Yorkshire Naturalists' Union. We have also to acknowledge assistance from Mr. T. W. Woodhead, of Huddersfield, on the flora of that area; Mr. R. C. Gaut for assistance in the survey of parts, and for lists; and many others who have taken the trouble to ascertain details necessary to the survey. We have specially to acknowledge our great indebtedness to Mr. J. G. Bartholomew, not only for the reproduction of the maps, but for much assistance in other ways.

PART I.: LEEDS AND HALIFAX DISTRICT.*

If the area represented in the present map be traversed from east to west on one of the railroads, the impression is first received of a thickly populated manufacturing area, with numerous collieries. In the western half, towns are less numerous; and valleys with grassy slopes, dotted with villages and homesteads, are presented The woods are limited to the stream-sides, while moorland edges form a fringe along the sky-line. With the aid of a good map, such as those of the Ordnance Survey or Messrs. Bartholomew's latest maps of the county, the towns seen in their true proportions are found to occupy less of the area than the earlier impressions led one to expect; and some idea of the numerous woods and extensive moors is obtained. In the preparation of this vegetation map, the areas represented as wood, uncultivated land, and cultivated land respectively on the ordnance maps, form a

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* Map, p 481

basis for the work; the limits of these are taken as correct unless observations on the spot show otherwise.

The vegetation of the area presents three subdivisions—

1. The Moorland.
2. The Woodland.
3. The Farmland.

1. The Moorland.

The political boundary between Yorkshire and Lancashire traverses the moorland throughout almost all this map; it therefore offers a convenient western limit. In order, however, to represent fully the characters of the vegetation, this limit has been taken far enough into Lancashire to show the falling slopes on that side of the Pennines. The highest altitudes of the moors are 1700 feet (515 metres) * on Boulsworth hill in the north-west, and 1909 feet (579 metres) on Black hill (Holme Moss) in the south. Thence the moors are almost continuous down to 1250 feet (380 metres), and in places descend to 900 feet (273 metres). The western part of the map is an extensive Millstone Grit plateau, dissected by numerous streams, which have cut their way through the surface rock, and formed deep narrow valleys, or "cloughs," in the shales below. In a few cases, the shales of the Pendleside or Yoredale series are reached at the bottom of these valleys. In the east, the Carboniferous Coal Measures overtop the gritstone rocks. Glacial clay is found on the moors west and north of Bradford, but is absent from the Calder-vale moors and southwards. The geology of the district is therefore very simple; and for œcological purposes, the area may be regarded as composed of hard rock and shale, both sandstone. The vegetation of the moorland is shown on the map under three primary divisions, each of which is easily recognized by its predominating colour when seen in mass: (1) the cotton-grass moor, greyish-green in early summer, and reddish-brown in autumn; (2) the heather, brown in winter, and passing through a summer green to autumn purple; (3) the rough grass, green in summer and yellowish-brown in winter. The selection of these types of vegetation is based, however, not on mere ease of recognition, but on broader principles, namely, difference in soil, water-supply, and other conditions of environment, which will be dealt with more fully later.

Moss Moor.—The great part of the moors is dominated by the cotton-grasses (*Eriophorum vaginatum* and *E. angustifolium*). The heather (*Calluna*) and the grass heaths are, as a rule, confined to the drier or steeper edges, or to isolated, outlying flanks and patches. The common cotton-grass (*E. vaginatum*), with its associates, extends in monotonous tufts for miles, and in this latitude forms the backbone of "the backbone

* The altitudes are those given on the maps of the Ordnance Survey.

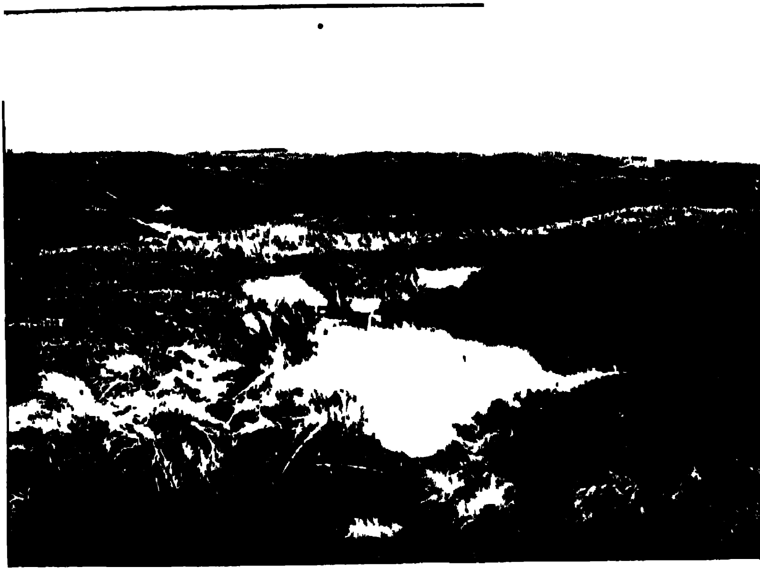

Fig. 1. On a Cotton grass moor. The bog-tarn rests on clay at the base of the peat; the banks show the depth of peat. The background is the drier moor on deep peat.

Fig. 2. Moss moor in June. Cotton-grass in fruit.

of England" itself. The cotton-grass flourishes best on the almost flat moor summit, where the rainfall is great, the drainage bad, and the peat thick and permanently wet or damp (Fig. 1).* These moors are locally known as "mosses;" and the vegetation of the area is extremely scanty in number of species. A few mosses and liverworts lie on the bare peat, a few species of algæ and lichens are not uncommon, now and then small fungi are seen, ferns are practically absent, and clubmosses are but rarely met with. The following are the flowering plants found in extreme cases of this Eriophorum association :—

†*Eriophorum vaginatum*, L. Usually dominant.
E. angustifolium, Roth. Sometimes dominant.
Empetrum nigrum, L. Occasionally dominant.
Rubus Chamæmorus, L. Sometimes abundant.
Vaccinium Myrtillus, L. Sometimes abundant.
Calluna Erica, DC. Not abundant.
Erica Tetralix, L. Not abundant.
Carex curta, Good. Infrequent.
Drosera rotundifolia, L. Rare.
Narthecium Ossifragum, Huds. Rare.
Lycopodium spp. Very rare.
Selaginella selaginoides, Gray Very rare.

Such tracts are usually most monotonous in appearance. In autumn and winter, the reddish-brown leaves of the cotton-grass present a dreary aspect. Some life is infused into the area in early spring, when the dull florets make their appearance. In early summer the masses of white fruits form snow-like patches visible from a considerable distance (Fig. 2). The Eriophorum association is not extensively developed in Perthshire or Midlothian (1900), though R. Smith's unpublished maps show it to be of great extent in the west of Scotland. It is thus an association typical of the western region of Britain, and it seems probable that the association does not reach its maximum development with a rainfall of less than 40 inches (100 cms.). The recording stations of the Halifax waterworks, situated in the Eriophorum area, indicate a mean annual rainfall of nearly 45 inches.

The Eriophorum moor is an example of the association known to German botanists as "Heidemoor" or "Moosmoor," and may be indicated by the English term "moss" or moss moor. The *Sphagnum*, or bog-moss, is regarded as an important element in the formation of the deep peat always found on the moss moor; yet in our area, while the peat is from 5 to 30 feet deep, *Sphagnum* beds are by no means conspicuous. The general impression received is that the peat is being gradually denuded or wasted; and this agrees with the conditions found in the neighbouring Kinderscout district of Derbyshire, as described by Sir E. Fry (1892).

On the bleak ridges of the upper moors the bilberry (*Vaccinium*

* The photographs for this paper were taken by Mr. W. B. Crump, M.A. (Halifax), who has generously placed them at our disposal.

† The nomenclature of the London Catalogue, 9th edit., is followed throughout

Myrtillus), a secondary social form of the Eriophorum and Calluna associations, becomes a rival for dominance; and in dry, rocky, wind-swept places it replaces the cotton-grass entirely. It has been considered advisable to record this type of vegetation on the map, because it has a connection with the Vaccinium slopes, recorded from 2000 feet upwards in Perthshire. Although the bilberry is nowhere so dominant or so extensively developed in the present map, the occurrence of the Vaccinium summit-ridge is characteristic (Fig. 3). It is not determined by altitude alone: its essential feature is that it forms the sky-limit of the moor, where it is exposed to all weathers. It is much drier than the "moss" below, more rocky, steeper, better drained, and the peat is shallower. The stations where this Vaccinium association occurs are—Holme moss (1750 to 1900 feet), Boulsworth hill (1650 to 1700 feet), West Nab (1500 to 1640 feet), and to a smaller extent on other summits. The rocky edges of the various moors are also tenanted by much Vaccinium. The following plants are characteristic:

Vaccinium Myrtillus, L. Dominant.
Empetrum nigrum, L. Often abundant.
Rubus Chamæmorus, L. Occasionally abundant.
Calluna Erica, DC. Common
Rumex Acetosella, L. "
Juncus squarrosus, L. "
Eriophorum vaginatum, L. Common.
E. angustifolium, Roth "
Deschampsia flexuosa, Trin. "
Festuca ovina, L. "
Nardus stricta, L. "
Lycopodium spp. Rare.

The case of Black hill (Holme Moss) is exceptional, because vegetation is almost completely absent for fully half a square mile at the summit. The surface here consists of black, damp or slushy, decaying peat, with no emerging rocks. Almost the only vegetation is afforded by the creeping shoots of *Eriophorum angustifolium*, which bind together to some extent the loose peat.

The Eriophorum moor and the Vaccinium ridge represent types of vegetation where the influence of man is very slight, because both are unsuited either for grazing or game. In the former, wide ditches are occasionally constructed to encourage drainage and the consequent growth of bilberry and heather, plants better adapted to the habits of grouse than the Eriophorum. The marked scarcity of heather on the moss moor is not emphasized in any literature relating to the vegetation of this district; in fact, the impression is conveyed that heather is the dominant plant. Whether the area now occupied by Eriophorum was formerly covered with heather is a question difficult to answer; but vegetation maps such as the present will furnish in time to come a basis for comparison of this and other changes of flora.

Heath or Heather Moor.—The heather (*Calluna*) becomes dominant only on the edges of the moss moor or on detached patches (Fig. 4). The heather area in South-West Yorkshire is much more limited than that of Northern Perthshire or North-East Yorkshire. Peat is present

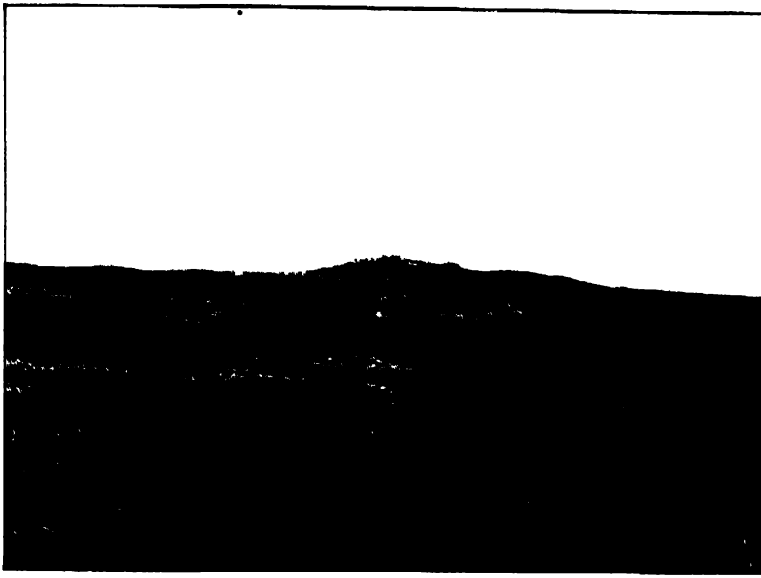

FIG. 3. Summit ridge of Boulsworth Hill. The vegetation is chiefly Vaccinium

FIG. 4. Crimsworth Head. Edge of a cotton-grass moor, with dark patches of heather on the slopes and grasses near the stream.

on the heath, varying from ·3 or 4 feet in thickness to a few inches; whereas on the Eriophorum moor the peat is sometimes 30 feet thick. The heaths are flat, or nearly so; and steep shaly hillsides are not heather-clad. The heather grows thickest and tallest in those places which are naturally well drained, and which are regularly and carefully fired by the keepers. The following plants are representative of the heather moor on the present map:—

Calluna Erica, DC. Dominant.	*Luzula erecta*, Desv
Ulex Gallii, Planch.	*Juncus squarrosus*, L.
Genista anglica, L.	*Scirpus cæspitosus*, L
Potentilla sylvestris, Neck.	*Carex Goodenowii*, J. Gay.
Vaccinium Vitis-Idæa, L.	*C. flacca*, Schreb.
V. Myrtillus, L.	*C. panicea*, L.
Erica cinerea, L.	*Agrostis vulgaris*, With
Pyrola media, Sw. Rare.	*Festuca ovina*, L.
Trientalis europæa, L. (one station)	*Nardus stricta*, L.
Rumex Acetosella, L.	*Lomaria Spicant*, Desv
Orchis latifolia, L. Rare.	*Lastræa Oreopteris*, Presl

In wet places the following also occur:—

Erica Tetralix, L.	*Potamogeton polygonifolius*, Pour.
Ranunculus Lenormandi, F. Schl	*Carex echinata*, Murr.
Drosera rotundifolia, L.	*C. flava*, L
Andromeda Polifolia, L. Rare.	*Deschampsia cæspitosa*, Beauv.
Narthecium Ossifragum, Huds.	*Molinia varia*, Schrank
Juncus conglomeratus, L.	*Sphagnum* spp

The heather vegetation, as will be seen, includes a greater variety of plants than that of the higher moors, and within itself presents several well-marked associations. Graebner, in a recent paper (1901), recognizes the heath or heather moor ("Calluna-heide") as a type of vegetation co-ordinate with the moss moor; but his description of the latter is confined to its occurrence at low altitudes only. He also recognizes as types "Tetralix-heide" and "Empetrum-heide," both of which are found in the present area. The Tetralix association forms a transition between our two types, occurring on the wet parts of the heath and on the margins of the moss moor; where well marked, it is shown by the letters "EH" on the Eriophorum moor colour. Graebner further subdivides his type into "Facies," most of which have been recognized in this survey, and in a more detailed scheme of colour could be represented.

Grassy Moorland.—The term "grass heath" (HPa) is here used to distinguish this vegetation from that which we call "natural pasture" (Pa). The latter is well developed on the moorland of the Mountain Limestone, and is characterized by a large number of plant-associates which do not belong to the heather vegetation. The grass heath, on the other hand, while dominated by grasses, includes many species already given as heath plants. The distinction thus made is recognized by

continental botanists, who use the term "Gras-heide," while our natural pasture corresponds to their "Wiesen." The grass heath of the present area, like the Calluna heath, is always on the edge of the moor plateau. Two types of grass heath occur: one is flat or nearly so, wet, somewhat peaty, and dominated by *Molinia* (Fig. 5); while the other occurs on steep slopes, and is dry, almost without peat, and dominated by *Nardus stricta*, *Deschampsia flexuosa*, and *Festuca ovina*. The best example of the former is Erringden Moor: the latter is extensively developed on the shaly slopes around Todmorden. The following is a selected list from the Molinia association:—

Molinia varia, Schrank. Dominant

Viola palustris, L.	*Juncus squarrosus*, L.
Montia fontana, L.	*J. conglomeratus*, L.
Lotus uliginosus, Schkuhr.	*Luzula erecta*, Desv.
Hydrocotyle vulgaris, L.	*Carex echinata*, Murr
Galium Witheringii (Sm.)	*C. flacca*, Schreb.
Vaccinium Myrtillus, L.	*C. flava*, L.
Schollera Oxycoccus, Roth	*C. Goodenowii*, Gay
Calluna Erica, DC.	*C. binervis*, Sm
Erica Tetralix, L.	*Deschampsia flexuosa*, Trin.
Narthecium Ossifragum, Huds.	*Nardus stricta*, L.

The dry grass heath occurs on the steep hill-slopes; and for this reason, probably, there is no peat. It is better suited for pasturage than the wet grass heath. The following species are represented:—

Festuca ovina, L. } One or both	*Calluna Erica*, DC
Nardus stricta, L. } dominant	*Erica cinerea*, L.
Deschampsia flexuosa, Trin.	*Rumex Acetosella*, L.
Aira præcox, L.	*Orchis maculata*, L.
Sieglingia decumbens, Bernh.	*Luzula erecta*, Desv.
Agrostis vulgaris, With.	*Carex pulicaris*, L. Not common
Viola lutea, Huds. Local.	*C. pilulifera*, L.
Genista anglica, L. Not common	*C. binervis*, Sm.
Ulex Gallii, Planch.	*Pteris aquilina*, L.
Potentilla sylvestris, Neck	*Lomaria Spicant*, Desv.
Galium saxatile, L.	*Lastræa Oreopteris*, Presl.
Vaccinium Myrtillus, L.	

On the whole, the grass heaths of this part of Yorkshire are limited in extent compared with North Yorkshire and Scotland. They also show fewer species, and are deficient in plants indicating good soils.

At the upper limit of cultivation many farms are derelict, or rapidly becoming so. Some of the pastures here are quite heathy in character, and are said by the farmers to be "running back to moor." The pastures furnish a connecting link between the heaths and the area of cultivation. They possess a rich and varied flora, many local rarities being found there. In addition to the heaths and grasses of the heaths, the following occur:—

FIG 5 Walshaw Dean Grass heath in the moorland valley of a stream Cotton grass moor on distant height

FIG 6 The Undergrowth of an open oak wood

Viola lutea, Huds. Local.
Hypericum pulchrum, L.
H. quadratum, Stokes.
Linum cartharticum, L.
Ulex Gallii, Planch.
Cytisus scoparius, Link.
Crataegus Oxyacantha, L.
Antennaria dioica, R. Br. Rare.
Gnaphalium sylvaticum, L. Rare.
Taraxacum palustre, DC.
Wahlenbergia hederacea, Reichb. Rare.
Erythraea Centaurium, Pers Not common.
Gentiana Amarella, L.
Digitalis purpurea, L.
Euphrasia officinalis, L.
Thymus Serpyllum, Fr. Rare.
Teucrium Scorodonia, L.
Betula pubescens, Ehrh (dwarfed).
Quercus Robur, L. (dwarfed)
Salix aurita, L.
Habenaria conopsea, Benth.
H. bifolia, R. Br.
H. viridis, R Br. Not common
Luzula erecta, Desv.
Carex, spp.
Briza media, L.
Ophioglossum vulgatum, L.
Botrychium Lunaria, Sw.

The relations of the foregoing moorland associations may be briefly summarized thus.

$$\begin{tikzcd}
 & & & \text{Vaccinium ridge.} \\
 & \text{Eriophorum moor.} \arrow[d] \arrow[urr] \arrow[drr] & & \\
 & \text{Calluna heath.} \arrow[rr] \arrow[d] & & \text{Vaccinium edge.} \\
\text{Festuca grass-heath.} & \text{Molinia grass-heath.} & & \text{Derelict pasture.} \arrow[ull, dashed] \\
\text{Woodland.} \arrow[u] \arrow[uur] \arrow[ur] & & \text{Farmland.} \arrow[ur] &
\end{tikzcd}$$

This table also furnishes some idea of the development of the various types of moorland. The Eriophorum moor passes upwards into the Vaccinium ridge and downwards into the Vaccinium edge and Calluna heath. It is also noteworthy that the Calluna heaths are all within the present altitudinal range of woodland, and remains of tree-trunks are occasionally found embedded in the peat. Amongst workers in North-West Germany, it is generally acknowledged that much of the heath area has been derived from former forest (Smith, W. G., 1902B). Whether the great stretches of Eriophorum moor have in post-glacial times been tree-clad is uncertain. The grass heaths are all of the heath type; but the Molinia type shows this relationship better than the Festuca heath. The latter, being on steep, shaly hillsides, was probably never covered with peat at all. It is possible that much of the grass heath was once wooded, and in a forest map would be shown in the upper oak forest zone. The heath and hill-pasture abut on the area of cultivation; and the upper farms have been enclosed from these, leaving a ragged fringe of moorland which has never been brought under the plough, either because too steep or too rocky. By selection, certain portions might profitably be converted into farmland; while it appears certain that good forestry would convert nearly all of these places into woodland.

2. The Woodland.

Woods occur from the edge of the moorland plateau down to sea-level. Throughout the whole area the oak is the dominant tree. In Flahault's vegetation survey of the south of France, ten types of forest are represented. In R. Smith's Scottish survey there are five, namely, oak, birch, pine, larch, and mixed lowland deciduous. In the present map, only three of these are considered worthy of special colours, namely, oak, mixed lowland (with beech), and pine. The birch wood or uppermost tree zone of the Scottish highlands is represented in the West Riding by a modification of the oak wood. Larch woods, so characteristic of the Scottish moorlands, are here quite subordinate, and included under pine woods. In the present paper the oak woods alone will be dealt with, the consideration of pine woods being deferred. The beech wood, so typical of Central Europe, is not well represented in South-West Yorkshire, except on or near the Permian tract. Beech is not uncommon, but its occurrence in parklands, or as small detached plantations, suggests artificial planting; and it seems best to consider it as an introduction into the oak wood. The woods where beech and other lowland deciduous trees outnumber the oak, are indicated on the map, because the presence of these trees tends to alter the whole character of the vegetation growing beneath; and where beech is present in quantity the association approaches that of the typical beech forest (Figs. 6 and 7).

Before considering the botanical features of the woodland, the topographical features of this area are of interest. The orographical maps of the ordnance survey, or those recently issued by Messrs. Bartholomew, show that the western or moorland area of the map is an almost continuous plateau, ranging from about 1250 feet upwards. The middle portion of the map consists of valleys and intervening uplands, sloping from the plateau downwards to the lowlands or eastern part of the map. Accompanying the general lowering of altitude from west to east, there is a decrease in the annual rainfall (see p. 396). The geology also changes with the decreasing altitude; and the western Millstone Grit gives place to the Coal Measures as surface rocks. This boundary is approximately indicated on our map by the places Hepworth, Huddersfield (west side), Stainland, Elland, Halifax (east side), Ogden, and Leeming; thence it turns eastward, passing near Shipley, Calverley, Kirkstall, and Roundhay (Leeds), and under the Permian near Barwick-in-Elmet. The Permian series occurs in the extreme east of this map, the boundary between it and the Coal Measures passing southwards from Garforth to Pontefract and Hickleton. The contour of the woods on our map offers a ready but fairly accurate means of distinguishing the Millstone Grit from the Coal Measure area. In the former the valleys are narrow with steep sides, and the woods

FIG. 7. The effect of Beech on the undergrowth.

appear as narrow strips; in the latter the valleys are broad with gentle slopes, and the woods in consequence appear broader and rounded.

OAK WOODS.—In the narrow western valleys the woods usually occur on the slopes and rarely rise to the open upland. As the valleys widen out on the Coal Measures, the oak woods are still mainly confined to the valleys, but emerge more from them. Three types of oak wood are recognized—

1. Clough Thicket or Wood.
2. Upland Oak Wood.
3. Lowland Oak Wood.

The lowland oak wood occurs below about 500 feet (152 metres). The dry oak wood occurs chiefly above this altitude, and extends upwards to 800 or 1000 feet, where it merges into the clough wood.

The Clough.—The moorland plateau of Millstone Grit finishes in a precipitous edge; and the waters from the moor, gathered into narrow but well-marked streams, descend abruptly over this edge, excavating it backwards and downwards to form a gorge, with a steep head and steep rocky slopes littered with weathering sandstones and shales. These gorges are locally known as "cloughs." The abrupt change in altitude and environment is at once perceptible in the vegetation, which changes rapidly from that of the moor edge to a loose thicket of shrubs and low trees, in many respects stamped with the characteristics of a wood. A useful account of the geology and natural history of Norland Clough is given in a series of papers in the *Halifax Naturalist* (1900). The typical clough is not crowded with tree vegetation; but trees and shrubs are abundant enough to form a loose thicket or scrub, sometimes dense enough to be regarded as a wood of the next class (Fig. 8). The following constitute the scrub of the clough :-

Oak	Blackthorn	Rose.
Birch	Bird-cherry.	Bilberry
Mountain Ash	Willows (three spp).	Ling.
Holly	Honeysuckle	Heaths (two spp.).
Hawthorn	Bramble	*Ulex Gallii*, Planch.

The arrangement of these elements varies from place to place. Here the taller trees and shrubs may be thickly clustered, there gorse; in other parts bilberry, heather, or bracken covers the ground. The herbaceous vegetation of the drier parts includes—

Viola Riviniana, Reich.	*Hieracium Pilosella*, L.	*Orchis maculata*, L.
Polygala serpyllacea, Weihe	*H. vulgatum*, Fries.	*Habenaria conopsea*, Benth
Hypericum pulchrum, L.	*Jasione montana*, L.	*Luzula campestris*, DC
Potentilla sylvestris, Neck	*Campanula rotundifolia*, L.	*Luzula erecta*, Desv.
Alchemilla vulgaris, L.	*Vaccinium Myrtillus*, L.	*Carex pilulifera*, L
Pimpinella Saxifraga, L.	*Calluna Erica*, DC.	*Agrostis vulgaris*, With.
Galium saxatile, L.	*Erica cinerea*, L.	*Sieglingia decumbens*, Bernh
Scabiosa Succisa, L.	*Pyrola media*, Sw. Rare.	*Festuca ovina*, L.
Solidago Virgaurea, L.	*Digitalis purpurea*, L.	*Pteris aquilina*, L.
Gnaphalium sylvaticum, L.	*Teucrium Scorodonia*, L.	*Lomaria Spicant*, Desv.
Centaurea nigra, L.	*Rumex Acetosella*, L.	*Lastrea Oreopteris*, Presl

Clough Swamp.—Parts of the clough are wet, and support a larger number of moisture-loving plants than the upper moorland:—

Ranunculus Lenormandi, F. Schultz
R. Flammula, L.
Viola palustris, L.
Lychnis Flos-cuculi, L.
Stellaria uliginosa, Murr
Montia fontana, L.
Hypericum quadratum, Stok
Lotus uliginosus, Schk
Spiræa Ulmaria, L
Drosera rotundifolia, L.
Callitriche stagnalis, Scop.
Hydrocotyle vulgaris, L
Œnanthe crocata, L.
Galium Witheringii (Sm.).
Achillea Ptarmica, L
Senecio aquaticus, Huds.
Cnicus palustris, Willd.
Crepis paludosa, Moench
Lysimachia nemorum, L.
Myosotis cæspitosa, F. Sch
M. palustris, Relh.
M. repens, G Don.
Veronica Beccabunga, L
Pinguicula vulgaris, L.
Scutellaria minor, Huds Rare.
Orchis latifolia, L.
Narthecium Ossifragum, Huds.
Juncus conglomeratus, L.
J lampocarpus, Ehrh.
J. acutifolius, Ehrh.
Potamogeton polygonifolius, Pour.
Scirpus setaceus, L.
Carex echinata, Murr.
C. Goodenowii, J. Gay.
C lævigata, Sm.
C. pendula, Huds Rare
C. binervis, Sm
C. fulva, Good. Rare
C flava, L (var.)
Agrostis palustris, Huds
Deschampsia cæspitosa, Beauv.
Holcus lanatus, L.
Equisetum limosum, Sm
E palustre, L

Mosses, hepaticæ, and algæ are well represented.

Upland Oak Woods.—These extend from 500 feet to 1000 feet (152 to 300 metres). They occupy dry rocky slopes on the Millstone Grit area The oak is usually dominant; but when the best of these trees are removed and no others planted, the birch becomes dominant, either alone or mixed with stunted oaks. There is reason to believe that before the expansion of the cultivated land to its present limits, the upland oak wood must have formed a well-marked zone of primitive forest, following the course of the valleys; but as disforesting has gone on without much attempt at replanting, the existing woods are only the meagre remains of this. Where replanting has been attempted, mixed plantations may occur on the site of the previous oak woods. In such cases the Scots and Austrian pines, spruce, larch (occasionally), sycamore, and beech are found in varying proportions; and all (except perhaps the larch) do well if suitable precautions are taken.

The loose canopy of the oak wood favours a thick undergrowth (Fig. 6), which, however, does not include a large number of species. This undergrowth may form a loose thicket of small shrubs. In less shaded parts the bilberry or bracken or grasses become dominant; while the rocky edges and open parts are not uncommonly covered with heather and some of its associates.

Lowland Oak Woods.—This name is given to what might equally well be called damp oak woods, or mixed deciduous woods. On the Millstone Grit, woods of this type are confined to the valley bottoms below an altitude of about 500 feet; but throughout the wider valleys and lower altitudes of the Coal Measures they are of greater extent. The woods seen in traversing the area by railway are usually of this kind. The oak is still a dominant tree, though the sycamore and

Fig. 8. Oak wood; in the Clough.

wych elm frequently share dominance. Ash, beech, and alder are less common, but still frequent; while horse-chestnut, sweet chestnut, poplars, the larger willows, and conifers, are occasionally planted. The best development of these oak woods occurs in the Dearne district around Barnsley.

The upland oak wood is usually dry and rocky, and deficient in humus: the lowland oak wood is damp, shaly, and richer in humus. The shade cast by the trees is much greater in the latter than in the former. Hence the flora of the latter is much richer in species, especially of the bulbous and early flowering kinds; while the flora of the upland oak wood contains a high proportion of late-flowering, moorland xerophytes, which are practically absent from the lowland oak wood. This difference is also observable in regard to mosses and liverworts. In order to facilitate comparison, the following full, but not exhaustive, lists are placed side by side:—

Upland Oak Wood

Trees

Quercus Robur, L.
Betula pubescens, Ehrh.
Pyrus Aucuparia, Ehrh.
Crataegus Oxyacantha, L.

Shrubby Forms

Ilex Aquifolium, L.
Corylus Avellana, L.
Prunus spinosa, L.
P. Padus, L.
Rubus Lindleianus, Lees
R. radula, Weihe
Rosa canina, L.
Hedera Helix, L.
Lonicera Periclymenum, L.
Vaccinium Myrtillus, L.
Calluna Erica, DC.
Salix aurita, L.
S. Caprea, L.
S. repens, L. Rare

Herbaceous or Ground Forms

Neckeria claviculata, N E.Br
Lychnis dioica, L.
Hypericum pulchrum, L.
Lathyrus montanus, Bernh
Potentilla sylvestris, Neck.
Epilobium angustifolium, L.
Galium saxatile, L.
Solidago Virgaurea, L.
Hieracium vulgatum, St

Lowland Oak Wood.

Trees.

Quercus Robur, L.
Betula pubescens, Ehrh
B. verrucosa, Ehrh
Fagus sylvatica, L.
Acer Pseudoplatanus, L.
Fraxinus excelsior, L.
Ulmus montana, Stokes
Prunus Avium, L.
P. Cerasus, L.
Crataegus Oxyacantha, L.
Alnus glutinosa, Medic
Salix fragilis, L.

Shrubby Forms

Ilex Aquifolium, L.
Corylus Avellana, L.
Acer campestre, L.
Ulex europaeus, L.
Rubus idaeus, L.
R. Sprengelii, Weihe
Rosa arvensis, Huds.
Hedera Helix, L.
Lonicera Periclymenum, L.
Sambucus nigra, L.
Viburnum Opulus, L.
Solanum Dulcamara, L.
Salix Caprea, L.

Herbaceous or Ground Forms.

Anemone nemorosa, L.
Ranunculus repens, L.
R. Ficaria, L.
Caltha palustris, L.
Trollius europaeus, L. Local
Cardamine pratensis, L.
C. amara, L.
C. flexuosa, With.
Viola Riviniana, Reich
Lychnis dioica, L.
Veronica Chamaedrys, L.
V. montana, L.
Lathraea Squamaria, L.
Nepeta Glechoma, Benth
Stachys Betonica, Benth
S. sylvatica, L.
Galeopsis Tetrahit, L.
Lamium Galeobdolon, Cran
Ajuga reptans, L.
Polygonum Bistorta, L.

Herbaceous or Ground Forms.

Jasione montana, L.
Campanula rotundifolia, L.
Pyrola media, Sw. Rare
P. minor, L. Rare
Digitalis purpurea, L.
Melampyrum montanum, Johnst.
Teucrium Scorodonia, L.
Rumex Acetosella, L.
Luzula erecta, Desv
Carex pilulifera, L.
Agrostis vulgaris, With
Deschampsia flexuosa, Tr
Holcus mollis, L.
Molinia varia, Schrank
Melica uniflora, Retz
Nardus stricta, L.
Pteris aquilina, L.
Lomaria Spicant, Desv
Lastræa Oreopteris, Presl
L. Filix-mas, Presl
L. palearea, Moore
L. dilatata, Presl

Herbaceous or Ground Forms.

Stellaria nemorum, L. Local.
S. Holostea, L.
Arenaria trinervia, L.
Geranium sylvaticum, L.
G. Robertianum, L.
Oxalis Acetosella, L.
Vicia sylvatica, L. Local
V. sepium, L.
Spiræa Ulmaria, L.
Geum urbanum, L.
G. rivale, L.
Fragaria vesca, L.
Potentilla Fragariastrum, Ehrh
Chrysosplenium oppositifolium, L.
C. alternifolium, L. Local
Circæa lutetiana, L.
Sanicula europæa, L.
Conopodium denudatum, Koch.
Myrrhis Odorata, Scop.
Chærophyllum temulum, L.
Angelica sylvestris, L.
Heracleum Sphondylium, L.
Caucalis Anthriscus, Huds
Galium Aparine, L.
Asperula odorata, L.
Valeriana sambucifolia, Willd.
V. dioica, L Local
Tussilago Farfara, L.
Petasites officinalis, Moench
Arctium minus, Bernh
Cnicus heterophyllus, Willd. Rare
Lapsana communis, L.
Crepis paludosa, Moench
Lactuca muralis, Fres.
Campanula latifolia, L. Rare.
Primula acaulis, L.
Lysimachia nemorum, L.
Myosotis palustris, Relh
M. sylvatica, Hoffm.

Rumex viridis, Sibth
R. Acetosa, L.
Mercurialis perennis, L.
Urtica dioica, L.
Neottia Nidus-avis, Rich. Rare
Epipactis latifolia, All Local
Orchis mascula, L.
Narcissus Pseudo-narcissus, L.
Tamus communis, L.
Allium ursinum, L.
Scilla festalis, Sal
Gagea fascicularis, Sal Local
Paris quadrifolia, L.
Juncus effusus, L.
Luzula vernalis, DC
L. maxima, DC
Carex remota, L.
C. pendula, Huds. Local
C. sylvatica, Huds. Local
C. lævigata, Sm.
Anthoxanthum odoratum, L.
Milium effusum, L.
Deschampsia cæspitosa, Beauv
Melica uniflora, Retz.
Poa nemoralis, L. Rare.
P. pratensis, L.
Festuca sylvatica, Vill. Rare
Bromus giganteus, L.
B. ramosus, Huds
Brachypodium gracile, Beauv.
Athyrium Filix-fœmina, Roth.
Lastræa Filix-mas, Presl
L. spinulosa, Presl.
L. dilatata, Presl.
Phegopteris Dryopteris. Fee. Rare.
P. polypodioides, Fee. Local.
Equisetum sylvaticum, L.

3. The Farmland, or Area of Cultivation.

This, with the woodland, includes all vegetation up to the limit of cultivation, and corresponds to H. C. Watson's Agrarian region. It is situated below 1250 feet (380 metres), except small isolated patches which occur up to nearly 1500 feet. On a reconstruction map like Flahault's, the greater part of the farmland would be regarded as enclosed from

the primitive forest, and included under one of the types of oak wood. Apart from the woodland, this area presents two distinct sub-types of vegetation—(1) uncultivated lands; (2) cultivated lands.

(1) UNCULTIVATED LANDS.—The area of cultivation has occasional patches of land which, never cultivated, have remained more or less primitive in character. Some of these are steep, rocky, or badly drained places belonging to the moor edge, unsuited for ploughing, and left island-like in the midst of cultivation; others are common grazing-grounds belonging to villages; others are wood-clearings never brought under the plough. Places of this kind deserve attention in a survey, because they give some evidence of the primitive vegetation of the district before agriculture displaced it. At the same time, human influences have affected them; they are generally used as grazing-grounds and are readily accessible to the plant-collector, hence too much weight cannot be laid on the evidence they offer. When of sufficient size to show on a map of this scale, the dominant vegetation of these areas is indicated by the colours used for grass, or heather, or mixtures of grass and heather. A special colour has been used to indicate lowland swamps with aquatic vegetation. In considering the uncultivated lands, we shall take them in the order of the geological areas, from west to east.

A. *Dry Heaths of the Millstone Grit Area.*—The uncultivated parts near the moorland may be recognized at once as vestiges of the primitive moor. The vegetation agrees closely with that already given as characteristic of grassy or heathery moor-edge. Away from the moorland, the heaths represent wood clearings, or a series of them may be correlated as remains of a larger moor or heath broken up by cultivation. An example of the latter occurs in the north-west corner of this map. It extends between the Wharfe and the Aire, from Otley Chevin south to Yeadon and east to Shadwell, near Leeds; it is a plateau of 800 feet altitude, declining southwards and eastwards to 500 feet. This area represents a former moor or moors known as Guiseley and Yeadon Moors, and Adel or Black Moor, a considerable tract of land which is now almost entirely under cultivation, and where wheat is grown up to 650 feet. Guiseley Moor now exists as a strip of heather vegetation along a road-bank above Otley Chevin, and as the warrens and coverts on the Chevin itself. The Black Moor at Adel extends from Meanwood Beck eastwards to near Wyke, Shadwell, and Roundhay, and on this area one may, within easy distance of Leeds, find several remnant patches of heath vegetation. The heath near Adel is shown by earlier lists of plants to have included almost all the species met with in the moor-edge vegetation; although at the present day only the common and more abundant remain, including three heaths, bilberry, gorse, and birch. These relics indicate the eastern end of a chain of moors of which the links, Rumbolds Moor and Barden Moor, are still wild

in character, and lead up to the Pennine mass of moorland. East of Adel, outliers of the Permian appear, and *Calluna* disappears. The most easterly occurrence of *Calluna* was found on the south side of Bramham Park, in the Permian area, but the *Calluna* itself is on an inlier of Millstone Grit.

The heaths found at lower altitudes are generally drained by streams whose banks support a vegetation which shows affinities with the clough swamp, the upper and lower oak zones, and the lowland swamp vegetation. The valley of the Meanwood Beck above Leeds may be taken as an example. The stream rises near Bramhope (600 feet) on what has been a moor, but is now farmland. At Adel Dam (400 feet) an artificial reservoir has become a swamp in which plants of the clough swamp and wet heath may be found with species of the lowland swamp. The stream from this place, till it enters the Coal Measures (about 200 feet), flows through a valley the banks of which present in succession grass heath with gorse and bracken; heath with heather, ericas, bilberry, and other associates; birch wood; alder and willow thicket; or oak woods more or less altered by introduced trees. Thus within a short excursion, almost all the types of the present map may be seen occupying limited areas. Mr. Lees (1880) gives a list of a hundred species in Meanwood valley, and this includes neither common plants nor many agricultural weeds which have become established. A zone of intermediate marsh vegetation is thus presented, and the following plants are characteristic. Some of them are found in the clough swamp, and almost all occur in the lowland aquatic vegetation.

Intermediate zone of marsh—

Nasturtium palustre, DC.
Cardamine amara, L.
C. pratensis, L.
Hypericum quadratum, Stokes.
Epilobium hirsutum, L.
E. obscurum, Schreb.
Hydrocotyle vulgaris, L.
Apium nodiflorum, Reichb.
Œnanthe crocata, L.
Galium Witheringi (Sm.).
Valeriana dioica, L.
Scrophularia nodosa, L.
Scutellaria galericulata, L.
Polygonum Hydropiper, L.
Polygonum amphibium, L.
Elodea canadensis, Michx.
Sparganium ramosum, Huds.
Lemna minor, L.
Alisma Plantago-aquatica, L.
Triglochin palustre, L.
Eleocharis palustris, R. Br.
Carex remota, L.
Phalaris arundinacea, L.
Equisetum palustre, L.

B. *The Coal Measure Common.*—This bears a strong resemblance to the Millstone Grit heath just described, and is quite distinct from the Permian common. It is as a rule distinguished by the rare occurrence of the plants of the *Calluna* heath, which are so frequent on the grit. Brierley Common, between Hemsworth and Cudworth, is the largest area of this kind, and other examples occur on the watersheds of the tributaries of the Dearne and Calder. The following list was taken

in July on Netherton Common, south of Wakefield, and shows the plants characteristic of such commons:

Nardus stricta, L. Dominant.	*Rubus fruticosus* (subspp.).
Agrostis vulgaris, With. "	*Rosa*, spp.
Festuca ovina, L. "	*Cratægus Oxyacantha*, L.
Anthoxanthum odoratum. "	*Galium saxatile*, L.
Ulex europæus, L. "	*Teucrium Scorodonia*, L.
Pteris aquilina, L. "	*Ajuga reptans*, L.
Hypericum pulchrum, L.	*Holcus mollis*, L.
Lotus corniculatus, L.	*Deschampsia cæspitosa*, Beauv.
Potentilla sylvestris, Neck.	

The hill known as Baildon common (927 feet), near Shipley, is another example. It is an outlier of the lower Coal Measures in the Millstone Grit. Its general grassy aspect at once distinguishes it from the dark heathery edges of Rumbolds moor, 2 miles off; a closer examination showed that it agrees with the list just given.

C. *The Permian Common.*—The Permian area is so much under cultivation that few uncultivated places are left. Disused quarries are common, and afford a refuge for a varied flora, generally with the character of a copse or thicket of ash and hazel. It is advisable to defer the description of the limestone vegetation till the next map of this series. On the present map, however, Hook Moor, near Aberford, is the best example of a primitive Permian grass moor met with in the survey of the West Riding. The vegetation is so different from any of the grass heaths already described that it is noteworthy:—

Brachypodium pinnatum, Beauv. Dominant.	*Rubus cæsius*, L.
Festuca ovina, L. Dominant.	*Rosa spinosissima*, L.
F. rubra, L. "	*R. canina*, L.
Bromus erectus, Huds. "	*R. arvensis*, Huds.
Helianthemum Chamæcistus, Mill.	*Bryonia dioica*, Jacq.
Viola odorata, L.	*Sambucus nigra*, L. (wild type)
V. hirta, L.	*Asperula cynanchica*, L.
V. silvestris, Reich.	*Carlina vulgaris*, L.
Polygala vulgaris, L.	*Primula veris*, L.
Euonymus europæus, L.	*Ligustrum vulgare*, L. (wild type).
Rhamnus catharticus, L.	*Gentiana Amarella*, L.
R. Frangula, L.	*Euphrasia officinalis*, L.
Ulex europæus, L.	*Thymus Serpyllum*, Fr.
Rubus idæus, L.	*Plantago media*, L.
R. rusticanus, Merc.	*Tamus communis*, L.
	Pteris aquilina, L.

The character of this association places it under the vegetation which we distinguish as Natural Pasture (Pa.). Other examples on this map are similarly indicated, but the chief development occurs in Part II. of this survey.

AQUATIC AND MARSH VEGETATION.—From the high moorland to the lowland there is an interesting change in the hydrophytic vegetation. The chief associations have been dealt with as they were found with

the types of drier vegetation, but it seems advisable to draw them together now. The course of any stream presents, in succession, the flat or gently sloping gathering grounds, the zone of rapid descent, and the zone of low gradient with slow currents. The extent of the three zones depends on the topography and geology of the country. In the present map, the marsh vegetation of the gathering grounds is somewhat varied, and is found in (1) the wet *Eriophorum* moor, (2) the wet parts of the heather moor, and (3) the *Molinia* or wet grass heath, all of which have already been referred to. The clough swamp is to be regarded as an accessory gathering-ground, where the waters of the moor are augmented by other springs exposed in the cutting back of the clough head.. The clough swamp indicates a double change in the stream: the chief zone of rapid descent begins here, and the stream enters the woodland zone. Both changes have a distinct effect on the vegetation. The presence of alders, willows, and other trees favours the increase of shade-preferring plants, but the high altitude, with its severer climate, limits the number of species. The rapid drainage of this zone is not favourable to the formation of reaches of still water, hence the reed-swamp is not represented; but small marshes may form, and some moisture-loving marginal plants occur (Fig. 9). The intermediate zone of marsh vegetation (see p. 392) appears when the streams approach the Coal Measures, and form swampy areas favourable to the aquatic and marsh vegetation of the lowlands. The presence of numerous canals and reservoirs also brings the lowland vegetation up into this zone; this has been shown for the parish of Halifax by Mr. Crump (1901), and Mr. Moss (1900). The true lowland aquatic vegetation occurs in stagnant or slow-moving waters, either on the Coal Measures or on alluvial deposits of the rivers. The more important of these are indicated on the map, and include swampy marshes and subsidences due to coal-mining. The aquatic vegetation here considered is that of altitudes below 300 feet (90 metres). The area is entirely fresh-water, but plants of the maritime type begin to appear immediately to the east of the present map. Owing to extensive river pollution, the aquatic vegetation is inferior to that of the area north of this (see Part II.). The following may be found: -

I. Free-floating plants—

Utricularia vulgaris, L.	*Stratiotes Aloides*, L. Rare
Ceratophyllum demersum, L. Rare.	*Lemna minor*, L.
Hydrocharis Morsus-ranæ, L.	*L. trisulca*, L.

II. Rooted plants with submerged or floating leaves—

Ranunculus aquatilis (*agg.*).	*Potamogeton natans*, L.
Hippuris vulgaris, L.	*P. crispus*, L.
Myriophyllum alterniflorum, DC.	*P. pectinatus*, L.
Hottonia palustris, L.	*Zannichellia palustris*, L.
Polygonum amphibium, L.	

FIG. 9 Oak wood Clough stream with marginal vegetation

III. **Reed swamp; plants with elongated leaves—**

Lythrum Salicaria, L.
Iris Pseudacorus, L.
Typha latifolia, L.
Sparganium ramosum, Huds.
S. simplex, Huds.
Acorus Calamus, L.
Alisma Plantago-aquatica, L.
Sagittaria sagittifolia, L.
Butomus umbellatus, L.
Phragmites communis, Trin.
Glyceria aquatica, Sm.
Equisetum limosum, Sm.
E. palustre, L.
E. maximum, Lam.

IV. **Marginal plants of the marsh (see also p. 388)—**

Ranunculus sceleratus, L.
Caltha palustris, L.
Nasturtium amphibium, R.Br.
Barbarea vulgaris, R. Br.
Epilobium hirsutum, L.
Sium erectum, Huds.
Œnanthe Phellandrium, Lam.
Bidens tripartita, L.
Lysimachia vulgaris, L.
Scrophularia aquatica, L.
Lycopus europæus, L.
Stachys palustris, L.
Carex acuta, L.
C. riparia, Curt.

The algæ have been recorded by Mr. W. West, of Bradford (1902).

(2) Cultivated Land.—The crops grown on the farmland indicate its capacity in regard to vegetation. The Board of Agriculture returns (1901) of the crops of the whole West Riding (of which the present map includes nearly one-third) are

Corn crops	Wheat	12,092 acres.
	Barley or bere ...	57,483 „
	Oats	75,874 „
	Rye	2,136 „
	Beans and peas ...	6,997 „
		184,582 „
Green crops	Potatoes	27,711 „
	Turnips and swedes	50,647 „
	Mangold ..	7,488 „
	Cabbage, vetches, etc ...	8,063 „
		93,909 „
Clover, sainfoin, and grasses under rotation	For hay ...	50,680 „
	Not for hay	29,692 „
		80,372 „
Permanent pasture, or grass not broken up in rotation, and not including mountain and heath land.	For hay	260,636 „
	Not for hay	566,507 „
		827,143 „

On the eastern lowlands and in the wide valleys of the Coal Measures, the farm rotations include all the crops given above. As the altitude increases towards the west, the cultivation of mangold, wheat, and the finer barleys gradually ceases, till on the upland farms the only crops of the ploughed land are oats, turnips, and the hardy bere (barley). At present the western part is almost entirely grass-land, and ploughed fields are only occasionally found. The farmland on the vegetation map is subdivided into a lower or wheat zone, and an upper or "no wheat" zone. Wheat is here taken as an indicator-plant, because it is already recognized as such in existing vegetation maps. Our wheat zone

represents in Britain the warmer parts of Central Europe. The area of the possible cultivation of wheat in Britain presents an interesting problem in plant distribution, because we have a gradual reduction of the area from south to north, and a well-marked limit in altitude. The restricted distribution does not appear to depend on soils alone, and one must look more to climatic factors as determining its range. The recording of the upper limit on these maps furnishes material for examining what the conditions really are. The problem, however, is one for special consideration, with the assistance of experienced meteorologists. The most important climatic condition required for the successful ripening of wheat is a hot summer relatively dry, and this can only be obtained where the rainfall is low. The rainfall and the average summer heat of a district are therefore determining factors. Since wheat is generally sown in autumn, and the young plants pass through the winter, the climatic conditions of that period must also have an influence. Dr. Herbertson, who has kindly assisted us in this matter, summarizes the necessary conditions as a function of (1) sunshine, (2) temperature, (3) moisture, (4) rainfall, (5) ground water-supply, during the whole growth-period. The climatology of Yorkshire in its relation to the distribution of various plants has been suggestively, but in a general way, discussed both by Mr. Lees (1888) and Mr. Baker (1885). Dr. Buchan (1862) gives 56° Fahr. (13° C.) as the average summer temperature required for the ripening of wheat in Scotland. In the Edinburgh district, R. Smith (1900) gives tables showing the mean July temperature and the rainfall at various stations. It appears from these that wheat ceases to be a regular crop of the farm at an altitude where the mean July temperature is below 56° Fahr. and the rainfall exceeds 32 to 33 inches per annum. Summarizing the rainfall in the present map, Dr. H. R. Mill says, "It is under 30 inches (76 cms.) east of a line through Pudsey, Cleckheaton, and Cawthorne: a roughly parallel line at from 5 to 8 miles westwards indicates the beginning of rainfalls over 46 inches, except in the valley of the Aire, where it is between 30 and 40 inches." The following table gives data:—

	Altitude.	Mean annual rainfall.	Zone of vegetation.
	Feet	Inches.	
South Milford	70	26	Wheat.
Wath-upon-Dearne	188	26	
Bradford	366	30	
Leeds (Allerton Hall)	418	28	
Halifax (Bellevue)	625	33	Near limit.
„ (Ramsden Wood)	815	37	No wheat.
„ (Ogden)	990	43·5	
Moors	1050–1380	47	
Woodhead Reservoir	660	49	
Rawtonstall, Clough Bridge	900	49	

The mean July temperature at Bradford, at 366 feet (*Y.N.U. Trans.*, 1900), is given as 59°·5 Fahr. (adopted mean for twenty-eight years). Mr. Crump (1901) gives statistics from two stations at Halifax; one at 526 feet gives the average from June to August as about 59° Fahr., another at 625 feet gives 56° Fahr. for the same period. From the maps in the volume on meteorology of Bartholomew's Physical Atlas (1899), it is fairly safe to assume that in the present area up to 900 feet (273 metres) the mean temperature for July is over 56° Fahr. (13° C.). The evidence for Yorkshire therefore supports the Scottish results—that throughout the wheat zone indicated on the map the average July temperature is at least 56° Fahr., and the rainfall is below 33 inches. In considering the woodland, we have already pointed out that the oak woods below about 500 feet (that is, within the wheat zone) have a type of vegetation richer in species than the upper oak belt. The patches of uncultivated land found within the wheat zone are too few to allow of any definite conclusions, yet they also present a more varied vegetation than the upland moors. In the farmland the upper and lower zones are recognized, not only by the crops, but also by the weeds of cultivation and the vegetation of the cultivated grass-land. The aquatic vegetation of the lowlands is also much richer in species than the "no wheat" zones.

The determination of a precise line to indicate the upper limit of the wheat area is rendered difficult at the present time by certain economic conditions. The declining price of wheat for many years has led to a marked shrinkage in the acreage devoted to it, and to an increase in grass-land. The returns of the Board of Agriculture (1891) for the whole West Riding show this:—

	Acres.		
1871	103,910	90 acres	per 1000 acres of cultivated land (not including nurseries, woods, or unenclosed moor or heath).
1881	75,142	63 „	
1891	58,614	48 „	
1901	42,092	–	

The reduction of wheat cultivation is evident over the whole area, but is most marked (1) in the vicinity of towns and manufacturing districts, where the conditions for growth are less favourable, and where dairy farming or market gardening is more profitable; (2) on poor, especially light, lands, which are unfavourable to the winter growth of autumn-sown wheat; (3) towards the upper limits of the wheat zone. The last-mentioned area of shrinkage is the most important for this survey, because it affects the determination of the upper limit of wheat. During the progress of the survey, wheat has always been recorded on the field maps, either from observation or from reliable information. In some districts it has been ascertained that wheat was grown, but the crop was uncertain, ripening only in favourable seasons; in other words, its upper limit was ascertained. On the map the letter "W"

above 500 feet (152 metres) indicates an actual observation on that spot, and the line defining the lower zone of cultivation from the upper is drawn from an average of these upper records. The average height of this line is from 600 to 700 feet, declining in the narrow western valleys to 400 feet. In the survey of the Edinburgh district, R. Smith fixed the wheat limit at 500 feet on northern exposures, rising to 700 feet on southern.

A transition zone between wheat and no-wheat was considered necessary to represent certain areas where wheat is now found occasionally over 700 feet, and was formerly grown to a larger extent. From the economic aspect of the present day, these transition areas cannot be considered as wheat-producing, but from the point of view of plant-geography it is necessary to indicate on the map that wheat may be grown there. The transition area occurs at an altitude of 800 to 1000 feet, near the junction of the Millstone Grit and lower Coal Measures. The Coal Measure valleys are wide, with gentle slopes, rising to comparatively low watersheds; these conditions are favourable for the cultivation of wheat, as our records show, up to the watershed. West of the Holme valley the transition area occurs on gentle slopes on the Millstone Grit, *e.g.* Honley Moor. It is noteworthy that this transition zone occurs on or about the rainfall line of 30 inches. In general aspect the vegetation of this zone is poor in species, and has more affinity with that of the no-wheat and moor-edge areas than with the true wheat zone. We therefore considered it advisable to represent it as shown on the map. In a more detailed survey, using maps on a larger scale and taking the underlying soils into consideration, the vegetation of the cultivated farm lands would be better represented by further subdivision. Such a survey would require careful investigation, and could be undertaken only by those having access to returns of crops, such as are furnished annually to the Board of Agriculture.

The weeds of arable land are chiefly annuals, many of which also occur in gardens or other freshly turned land. The greatest variety of weeds is found at low altitudes and in the richer land of the wheat zone; with increasing altitude many of the species cease to be prominent weeds and become casuals. The practice of using seed grain imported from a new district aids in spreading weeds, hence lowland species may be recorded occasionally at higher altitudes than usual, but they soon die out unless suited to the locality. A list of eighty-four weeds of arable land in Yorkshire, when arranged according to the altitudes given by Lees (1888), show about forty-four occurring above the wheat line; but these altitudes are the range of the species, not its range as a weed, which is generally lower. In a list of "One Hundred Yorkshire Weeds," compiled by us for the Agricultural Department of the Yorkshire College, sixty-three are common weeds of arable land; and

of these not more than forty-two occur above the wheat line. The following is a short list of characteristic species :—

CHIEFLY IN WHEAT ZONE.	IN BOTH ZONES.
Papaver Rhœas, L.	*Bursa Bursa-pastoris*, Web.
Raphanus Raphanistrum, L.	*Brassica Sinapistrum*, Boiss.
Viola arvensis, Murr.	*Viola tricolor*, L.
Lychnis Githago, Scop.	*Stellaria media*, Cyr.
Æthusa Cynapium, L.	*Spergula arvensis*, L.
Scandix Pecten-Veneris, L.	*Matricaria inodora*, L.
Matricaria Chamomilla, L.	*Tussilago Farfara*, L.
Chrysanthemum segetum, L.	*Senecio vulgaris*, L.
Sonchus arvensis, L.	*Sonchus asper*, Hoffm.
Chenopodium album, L.	*Atriplex patula*, L.
Polygonum Convolvulus, L.	*Polygonum aviculare*, L.
Euphorbia exigua, L.	*Euphorbia Peplus*, L.

Grass-land.—A large proportion of the farm-land is now left permanently as grass, but almost every field shows the ridges and furrows left on land which has been ploughed. In reclaiming the land from moor or heath, it is usual to enclose and plough it, and after taking one or more crops from it, to sow down with grasses. Many of the fields in the upper zone have probably only been once ploughed, but generally the land has been broken up oftener. The grass-land of the no-wheat zone of the western uplands is, as a rule, poorly cultivated. The mixed herbage yields one crop of hay each summer, and is then grazed till winter. In spring, the manure from stables and yards is distributed over the fields, and beyond this, little manuring takes place. On some farms, lime is applied at intervals of a few years, and on this soil, consisting chiefly of sands and shales, the beneficial result on the herbage is very marked.

In the eastern lowland part of the map, over the Coal Measures, more land is regularly ploughed, but a considerable acreage is permanently grass. Some of the grass-fields are used only for grazing: others are reserved for meadow hay. The meadows yield one or two crops of hay annually, and are well manured to encourage the larger grasses. Sward-forming grasses are preferred on the pastures. In regard to the numerous associates of the grasses which together make up the sward of a pasture or meadow, we have compared their range of distribution, and find that a considerable proportion cease at about 600 feet, others at 900 feet, while the rest ascend to altitudes above 1250 feet.

The pastures and meadows overlying the Permian limestone have a characteristic vegetation. In early summer especially, their bright green colour contrasts strongly with the dull green of pasture on adjoining formations. The constituents of the Permian vegetation are reserved for Part II. of this survey.

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FROM QUITO TO THE AMAZON VIÂ THE RIVER NAPO.

By A. HAMILTON RICE, B.A., F.R.G.S.

ON August 12, 1901, after the usual delay incidental to the departure upon every journey in South America, either for small distances or great, five miserable specimens of animals, claimed to be horses and mules, two arrieros, my negro servant and I turned our backs upon Quito, bound for the Indian village of Papallacta, two days distant. Mr. Söderström, the English consul, who had been my friend and benefactor in every possible way during my stay in Quito, accompanied us out of the city some 4 miles, bidding me God-speed, near the crumbling church dedicated to the Virgin of Guadeloupe, which marks the village of Guapulo. There is a fair road, first through the hills and then upon the open, with signs on all sides of Cotopaxi's violence, to the fever-infested and lifeless village of Tumbaco, where it is said no stranger can pass the night without contracting severe fever; and its hygienic conditions may be judged by the fact that its enterprising inhabitants let their dead remain unburied for days, never removing them from the huts, the natural decomposition process being aided by flocks of the carrion crow, or *gallinazo*, so called. Here some change of beasts was made, and the number increased from five to six, as the road was reported to be in bad condition—bad in Ecuador would be execrable, if not impassable, elsewhere.

The trail from Tumbaco is a sandy one, through a dreary country of a monotonously undulating character, with a stream to be crossed which reaches the flanks of the animals. About sunset, shortly after getting into the hills, the low rambling buildings of the *hacienda* Itulcachi appeared in view, and in a short time we were past the heavy gateway, and in the spacious courtyard the Indian retainers in a leisurely way helped the arrieros to unpack the loads, while a tall, big-limbed young fellow went to summon the master in charge. He soon appeared, a typical Ecuadorian, in a large, high-pointed, broad-rimmed hat, a serviceable poncho, wide trousers, and big spurs; he accorded me a hearty welcome, extending both hands to grasp mine, and the look of cordiality and good feeling which overspread his lean, leathery, and bronzed countenance more than made up for the words he wished to

utter, for we did not understand each other's language. Evidently Itulcachi is experiencing more prosperity under the sway of Señor Don José Madrid than it did at the period when Orton described his night there. A splendid feast was prepared in my honour, to which only Señor Madrid and myself sat down, eating with our hats on, as is the custom, and served by several Indian women, one of whom had her baby strapped to her back, the infant sleeping peacefully meanwhile. In addition to the bottles of wine with which the table was loaded, bowls of delicious milk were brought in answer to my query of "leche," proving that the milk-producing qualities of the Itulcachi herds have increased in proportion with the general prosperity. One also had for the last time the luxury of a bed, and a wash-basin and jug to look at, presumably for ornament, as they were covered with dust, and served no practical use for ablution.

We made a fairly early start the next morning, with the whole household assembled to see us off, and loaded with presents of wine and food from the hospitable señor. The trail began abruptly upward, rough and uneven. Looking back, the hacienda with its innumerable cattle lay far below us. The day at first promised fine, but rain, thick driving mists. and a cold wind succeeded the sunshine as we ascended towards the summit. The trail is in many places obliterated, and at times difficult for the ill-conditioned beasts, who plainly showed signs of weariness. The arrieros were indefatigable in their efforts to drive them up the steep slopes, persuading, threatening with the voice, and lashing with stout-thong whips until the poor animals' exposed sides and hams were covered with weals from the severe and continuous flogging. Some two hours after noon the summit was crossed; from here to Papallacta it is a steady descent. I could discover no signs of a trail, simply a seemingly endless succession of bog and morass, in which the animals wallowed and floundered, or slippery slopes down which they glissaded. Some held their feet, others went like grain-bags down a shute. Several times it was necessary to dismount to get across the mud-holes, the beasts emerging on the other side miserable objects covered with the filthy mud, which reached above their hind-quarters. The stamina of the mules was in marked contrast to the horses, decidedly in favour of the mules. They were stronger in bearing weight, their endurance greater, their intelligence and willingness far more exemplified, nor did their small hoofs and legs sink so deep into the mire. Several times the horses fell and wearied themselves further, in their weakened condition, by their ineffectual attempts to regain their feet.

Papallacta was reached about 5 p.m., a hamlet of some twenty-five or thirty huts situated in the bottom of a deep bowl-shaped valley, which accounts for the gloom which oppresses one. The yapping of a dog was the only sign of life as we wound our way past the shacks to

the governor-general's palace, a substantial edifice of the hut order consisting of a stout frame of logs, with a finish of mud-plastering and a thatched roof. The governor, attired in a pair of drawers reaching halfway down his thighs and a ragged poncho, received me affably, making his house over to me for the time being, with the exception of a small portion of one end reserved for his family. The furnishing of the house further proclaimed him a man of simple tastes. Three stones on the ground, between which a fire was built, constituted the fire-place and stove; one iron and twice as many copper pots, several trenchers, bowls, and spoons hewn from wood, with two flat stones of unequal size for grinding corn, a primitive mill which was being industriously worked by a dusky young woman, completed the culinary articles. Several logs of varying circumference, over which was thrown a skin, as bed, and a round hollowed piece of board with three legs of unequal length, like an uneven milking-stool, made up the luxuries of furniture.

The Papallactans are a very short people: many of the men do not stand 5 feet high, and the women considerably less; 4 feet would be a good height, and a few inches under this is common. The men are thick-set, with enormous development of calf and thigh muscles, slender wrists and small hands, thick ankles and large triangular-shaped feet. The women are slender, ill-nourished and wizened, though some of the younger females possessed good features and comely countenances. Their dress consists in most cases of a strip of blue *lienza* cloth fastened round the loins, reaching to the knees, and necklaces made from old Spanish coins, with drilled holes and a cord passed through. The men in most cases, in addition to the loin-cloth, carry a poncho. The hair of both sexes is straight, black, coarse, and the skin a decided brown. The male skull is relatively and actually large, prognathism not marked. In the normal human being the femur is the longest bone in the body, but in several of the males whom I measured, taking the great trochanter of the femur and measuring to the external condyle, and making allowance for the difference between tuberosity and head, then measuring tibia from internal condyle to internal malleolus, the tibia was a trifle the longer.*

On the morning following my arrival, long before daylight, the accommodating governor-general was astir, asking for a few centavos that he might obtain for me some eggs and milk for breakfast. After an early meal, a much-wizened female appeared with a gift of fruit. Small and round, it resembled externally a miniature orange; inside it

* It is remarkable that here, in the north-east corner of Ecuador, a people exists similarly proportioned to the Aymara race living on the Titicaca tableland, of whom David Forbes, in his 'Aymara Indians,' says, "Instead of the thigh being, as in all other known nations, longer than the leg, it would appear to be, on the contrary, slightly shorter."

was of a soft pulpy consistency, with a tremendous number of seeds. The native way of eating appeared the most practical—to bite out a piece of the skin, devouring the contents much in the same way as a small boy sucks an orange.

The woman was followed by two of the three principal magistrates of the village, termed judges, one municipal and the other a one-eyed individual styled "the judicial," so my host informed my negro servant Tino, who performed the very important office of interpreter, speaking both Spanish and English fluently. The judges gravely shook hands with me, adding something in Quichua. To the governor-general, who understood Spanish, but could not read, Tino, in an impressive voice befitting the solemnity of the occasion, read the government documents which Señor Moncayo, Secretary of the Interior, had given me before I left Quito. The governor listened with rapt attention, interrupting only to put into Quichua, so that the others might comprehend its import. The men who were to be my porters began to arrive one by one. Each received five *sucres* (roughly about ten shillings) in small silver pieces, the usual price as named in the document I brought for performing the journey from Papallacta to Archidona. Each portion was gravely counted out and handed over by the governor. Before leaving Guayáquil I provided myself with £15, in coin of ten and five centavos value, which I found very useful in the interior, the natives having a decided liking for it, utterly disdaining the paper money.

The business transaction took up most of the day, becoming a town meeting, all the women and children assembling to listen and have a word. First it was declared by all impossible to start for two days, but when the *chicha*, which had been brought from Quito, was circulated freely, and a jack-knife apiece offered to the men as an extra inducement, they decided to go on the morrow. Each man selected the articles which were to make up his pack, the customary weight for a peon being three arrobas, or 75 lbs.

Next morning the governor's house presented a scene of bustle, women helping their husbands do up their packs, or drawing them aside for farewell messages and last words. Each peon carried a strong stiff rod of 6 feet length, packs fastened to their backs by means of portage straps made of strong strips of bark—one carried across the forehead, a second passed over the arms and around the chest. Some used a form of wicker basket lined with big green leaves, designed to keep the food and other perishable articles dry.

The one-eyed judge, with considerable manner, escorted me to the small meadow behind the governor's house, where the Archidona trail begins; the peons, following, gathered in a circle, drove their staffs into the ground, at which the women set up a wail, the men giving a weird chant-like answer. Felipe, the leader, was an intelligent man, with

whom further acquaintance bred respect and admiration. The governor at the last moment decided to go as far as Baeza, the present of a flannel shirt and an old saddle influencing him much in my favour. A mere slip of a girl accompanied the men, bearing on her back a load of 35 lbs.

The trail strikes immediately into the forest, and is a muddy, slippery, uneven one from the very first. It leads in an easterly direction along the left bank of a stream, into whose waters we were forced from time to time on account of the impenetrable denseness of the thicket growth. In the course of the day's journey, eight Indians from Archidona glided silently past, more after the manner of spectres than human beings, disappearing in the forest gloom as suddenly as they had come. They were of taller stature, more slender build, more lithe action and graceful movement than the Papallactans, destitute of all covering except a narrow breech-clout, their long black hair falling down upon their shoulders, whereas the Papallacta men wore theirs cropped short. From time to time the human train halted for a respite, fifty minutes to an hour being the stretch a peon could go with from 60 to 75 lbs. upon his back without stopping for rest, food, or drink, over one of the roughest, hardest routes of the world, a passage through which man forces himself, combating at every turn all obstacles that it seems possible Nature can throw in the way of his advance. Camp was struck at four o'clock, advantage being taken of a previously erected palm-leaf roofed shelter, a simple construction which any Indian erects in a few minutes—two forked poles placed upright, with a connecting ridge pole, against which a number of sticks are leaned; over these they dexterously weave a waterproof roof of big palm leaves as protection against the almost inevitable nightly shower. An animal was brought in a little smaller than a badger. Felipe called it a wild guinea-pig. Everything was devoured (*bestia fœmenei generis fuit et gravidas*), and all with a rapaciousness which left no doubt in one's mind as to their appreciation of such delicacies. The beast was caught in a trap of simple contrivance.

Early next morning saw the departure of the little girl back to Papallacta, a pack of large wooden trenchers strapped to her back—freight which had been waiting at this spot for transportation for some time—and our advance along a path more difficult than the first day. We still clung to the left bank of the stream, known as the Maspa, the trail ascending and descending along the steep sides of densely wooded hills, down whose slopes innumerable water-threads trickled, making the path treacherously slippery with a slimy mud. The raucous cataracts falling over cliffs washed portions of the path away, leaving no foothold, yet the manner in which the Indians threaded, picked, fought their way, cumbered as they were with their heavy packs, excited deepest admiration. At one point for some distance

landslides obliterate the path; the bank formed is excessively steep, composed of loose rolling stones and scree. With each foothold the mass gives way, rolling and tumbling down into the whirlpools and eddies of the swift, roaring river beneath.

At 2 p.m. an Indian hut in a little clearing was reached; at the same time four Archidona Indians glided past in their noiseless adder-like fashion. At this spot, to which Orton ascribes the name Pachamama, the night was passed, one uncomfortable for me on account of the unusual interest my head and body proved to the innumerable guinea-pigs which infested the dwelling, literally swarming over the floor and my bed of rushes. The governer decided suddenly he would not proceed to Baeza, and two others of the peons having become in a certain degree adynamic, the governor procured for me three fresh peons, who put in an appearance in the morning, accompanied by a most cowed, miserable, mangy, yellow dog. Of all who had a hard time on the journey, the dog's lot was certainly the worst, half drowned in the rivers, starved, lacerated, at times in imminent danger of losing its life in the mud; it was still, however, in the bedraggled procession which five days later straggled into Archidona. The third day the paths continued the same for six hours, rough or mud sloughs, and, the hillsides being steep, one's left leg was always at a greater elevation than the right; all efforts to keep an equilibrium were unavailing, every few yards meaning a fall—great clods of mud adhered to one's boots, greasing them in a treacherous manner, upsetting the negro and myself again and again. The Indians in their bare feet fared decidedly better.

By two o'clock a bridge of the cantilever type was reached, a rude though ingenious feat of engineering, consisting of three very long logs lashed together, and of these there are three parts. The two pieces which extend from either shore to support the midstream portion are held in position by the weight of a huge pile of rocks in such a manner that the logs are elevated at a steep angle, the central portion of the bridge being considerably raised above the river. The bridge sways and swings in anything but a reassuring way, and only one man may cross at a time, a slip or any other accident meaning certain death, for none but a lunatic could ever have hope of being saved, once hurled into the mad rush of the rapids and boiling cauldrons of whirlpools which now characterized the stream. It rushes along with terrific force, undermining the hills on either side, and before reaching the bridge, on the left bank is the result of what has been a very severe and extensive landslip, awful now to behold in its quiescent devastation. Huge masses of *débris*, great rock, enormous trunks of trees twisted inextricably, torn, rent asunder, and piled high in the most distorted and contorted manner, forming a barrier passable only by the generous use of machetes. In the upturned soil a dwarf vegetation in some

places fights for a place, and hundreds of turbulent little streams run down the slopes, but these signs of growth and activity fail utterly to shake off the awed feelings created by so eerie a scene of violence and desolation.

After crossing the bridge, it is a two hours' hard pull, the greater part up a steep hill, with every step one's feet seeming to go a bit deeper in the black soft mud before Baeza is reached. This settlement consists of a few huts inhabited by Indians, at the largest of which it is customary for the traveller to accept hospitality, such as it is. Baeza seems wrongly located on Wolf's map of the Oriente. He has placed it to the north-east of Pepallacta, yet the trail from thence runs east, varying sometimes to a southerly direction. Orton has done the same; I do not think it is so far north. From Baeza the trail ascends straight up the side of a hill, from the summit of which the first expansive view is obtained of the forest-covered mountains to the east, north, and south. They run in no regular series, but are closely packed, and none rises above timber line.

Descending the southern slope, the really bad part of the trail commences—endless successions of swamps; one is plunged over knee-deep in the bog earth and slimy filth of ooze-like mud, whose monotony is varied by pools of stagnant, foul-smelling water, into which I went twice waist-deep in the vain endeavour to keep my balance on the narrow sunken logs, which in some places are submerged, serving as extra difficulties to overcome. There is no possibility of getting round the mud-holes and sloughs by *détours* or flank movements, the forest being dense and overgrown with such impenetrable vegetation as to successfully defy attempts of any sort. From many of the tree-trunks project sharp, needle like spines, which tear any clothing they may happen to catch, and lacerate the hands of those unfortunates whose minds, for the moment forgetful, worried, and exhausted by the miry sea of perplexities and difficulties, instinctively reach out to grasp the trunks in order to save themselves. This sort of thing lasts for two days; then the trail improves slightly again. It is discouraging, heartrending, suffering work; through it all one wonders how the peons ever got on, burdened with their heavy packs, pitiful specimens of humanity, with their stertorous breathing, bodies and limbs smeared and bedaubed with mud. Rain fell at frequent intervals, contributing to the general gloom.

Late in the day the Cosanga river was reached; camp was made on the left bank. Next morning we continued up the left bank for three hours, wading innumerable brooks, and following the devious windings to a spot where the river may be most easily forded. One Indian, the sturdiest of them all, was bowled over in the current, and of course it must needs be he who carried the camera; fortunately, not much damage was done. From here, for two hours, comes the worst stretch

of the whole journey, then the ascent of the Guacanayo ridge, whose sides and summit are clothed with a dense growth of timber, except where destructive landslides interrupt the wooded continuity. At times the summit is reported to be buried in snow, waist-deep, when progress, of necessity, becomes delayed. In the descent, the path is literally tunnelled in places, gouged out by mountain torrents and roofed in by fallen trees. The hard rains rendered any fire impossible, and clothes and boots, mud-soaked and drenched, remained in that condition till Archidona was reached the afternoon of the seventh day.

On the sixth day we met eight Indians coming from Archidona, from one of whom I obtained three lemons and a plantain, great delicacies after a diet of chocolate and barley-meal water. By noon we reached and crossed the Cochachimbamba, not without some difficulty, for while the river is much narrower than the Cosanga, it is deeper, the bottom more treacherous, and the current very swift. A change in the size and luxuriance of vegetable life begins to assert itself; tall trees rear themselves proudly above the rank profusion of tropical plants, beautiful in outline and grace of conformation when not disguised by the reticulated, inextricable substance of countless vines and spar-like lianas.

For the last 10 miles before Archidona is reached the path becomes uncomfortably narrow, the slippery yellow mud forming no foothold, and it is with a sigh of relief that the cane and banana groves are beheld, and the sense of having at last arrived is experienced. The governor-general, Señor Zapata, the chief executive of the Oriente, came to meet me and escort me to the Government House, a ramshackle affair of split bamboo, where he and several of the other government officials reside. Our arrival occasioned a momentary excitement, and the entire white population, consisting of some dozen men, officials and traders, came running over to see who it might be. None of them knew a word of English. The peons were immediately taken in charge by friends, and the yells and shouts of the drunken orgy held in their honour lasted till far into the night. Under the administration of President Alfaro, some radical changes have been effected, one of which has been the banishment of the Jesuits from the Oriente, and their authority in regard to the religious welfare of the Indians invested with the governor. Zapata, a young man of some energy, has gone so far as to build a church of the *corral* order of architecture, but just how and at what time use shall be made of it is not as yet decided; on Sunday mornings, when the full population of Archidona assemble 500 strong, they are put to work clearing land which Zapata is anxious to bring under cultivation; and the regular thing in the sabbath afternoon is to get as drunk as possible.

Concerning the natives, the men are tall, some 6 feet, well proportioned, and very muscular; several resembled the Greek idea

of physical beauty as regards torso and limbs. They wear the hair long, completely covering the ears and clipped off square over the forehead, which gives them a wild appearance. They paint their faces with a red pigment, the prevailing style being three lines drawn obliquely from a point just below the inner canthus across the cheeks, sometimes a line carried over the nose, and the grotesque effect further elaborated by a great daub all around the mouth. There is considerable variation, however, among them as regards physical type, for in addition to the aforementioned are those of a slender, lithe build, others of a burly appearance, rendered so by marked enlargement of the abdomen; especially was the protruding belly noticeable among all the very young children I saw on the Napo. It is said they swell themselves up by eating earth, which all the Indian children do. Some of the men's faces and bodies were covered with melasmic spots, varying from the size of a shilling piece to splashes. The women for the most part are small, round-shouldered, shy creatures; from their demeanour and general actions there would be no hesitation in assuming they occupied an inferior position. At meals they serve the men, afterwards eating what may remain. Both sexes have a fondness for necklaces composed of small glass beads, and some, of an æsthetic turn, make for themselves neck-bands of ingenious and pretty design. Some of the male dandies had sticks of bamboo inserted into their ears, protruding upward and out beyond their faces for some inches. The colour of these individuals is not a dark red, as Orton states, but a brown hue.

There has been in some men's minds the idea that the native of South America was of the stock, or closely allied to the race or family, of which the Japanese and Filipino form a part. It is claimed that, in the very young of these, two pigmentation spots are to be seen in the lumbar region on either side of the spine, which, however, disappear in the course of months or a few years after birth. Carefully examining every infant of from a few hours to two years of age that could be found from Guayaquil to the Amazon, in every case there was not the slightest trace of such markings to be found.

My idea, formed from reading Orton, of the apathy and laconicism of the Napo aborigines was rudely dispelled by a tremendous row and wordy warfare which took place on an early Sunday afternoon between the governor and several Indians. Any doubts as to whether these Indians are capable of speaking long sentences were completely dispelled, and they showed themselves capable of powerful and forcible argument, intonating in a loud, stammering, guttural way. They also at times exhibited great curiosity,* a camera, a watch, or a gun exciting

* Every one in Archidona is curious. The whites would never let me dress alone and daily rummaged through my packs and effects, being ably seconded by the Indians. Any attempt to do writing was entirely futile.

intense interest. They do a little hunting, more fishing (fishing is done in every case by very skilfully weaved, neatly executed nets), and considerable drinking, women being the drudges who perform the work. A sitting posture as known to us they never indulge in, but invariably squat upon their haunches. The chiefs carry long silver-headed canes and wear red caps and little red coats, which, with their loin-cloths, complete the sum total of wearing apparel. The principal duty of these notables seems to be directed toward large consumption of *chicha* and to remain in a chronic state of bibulous conviviality.

From Archidona to Napo it is six hours over a good trail, with two rivers to ford. The Jesuit church is in ruins, and there is an air of desertion about the place, most of the Indians having migrated elsewhere. It is here that one George Edwards, an American, interestingly mentioned by Orton, was foully murdered in 1896, concerning whose death no action was ever taken. Edwards, soon after the American Civil War, went to Ecuador and settled in the wilderness. He was held in high esteem by the Indians for his fair-mindedness, honourable dealings, and upright qualities. To within a few months of his death he had the companionship of a dog, but that friend dying, and the old man realizing that his years were telling on him, had determined to leave the wilderness which had been his home for so long and return to his native New England. Voluntarily he had resigned himself to this isolated spot, wore his hair hanging long upon his shoulders, and surrounded by his pets, tamed animals and birds from the forest, he existed in true Crusoe style. Reports had been brought across the mountains by Indians concerning the hoard of gold Edwards had accumulated in his twenty-five years of residence, and vague rumours along the coast from Guayaquil to Panama reached the ears of two Portuguese. One of these, a stranger to residents of Quito, penetrated into the Oriente, shortly returning to the coast to join his companion, and upon him is supposed to rest the guilt, the double crime of arson and murder. The charred ruins of Edwards's house, a little removed from Napo village, serve to distinguish it from the others wrecked through rottenness and decay. The *blanco*, or trader or judge, who was to get me Indians, spent several days in fruitless search before he obtained for me three villainous-looking, under-sized creatures, who were to accompany me four hours down the river to a village where others could be obtained. I purchased from the judge a heavy, narrow dugout, 30 feet long, and without regret bade adieu to the tumble down shelter, whose sole dignity consisted in its name, Government House, the only possible place of lodging.. I paid my Indians, in advance, two yards apiece of *lienzo* cloth, as is always customary in the country, though it is well not to pay too long in advance in Archidona; I paid them the day before for the

portaging to be done to Napo; they immediately invested their wealth in *chicha*, and at the appointed time of starting some were nowhere to be found, and the others in so advanced a state of intoxication as to be entirely useless.

Very soon after leaving Napo the first rapids are encountered, of a series which succeed each other in rapid succession for the next 100 miles. The banks of the river here are high and precipitous, and present the appearance of having been cut out by the stream; the bed is filled with rock of every size. Napo is a village of erratic existence, most of whose bamboo structures, including church and ramshackle Government House, are in ruins. Here the navigable part of the Napo for canoes begins. The river is narrow and swift of current, with many short, smooth reaches graded out of the weaker structure of land formation which seems to exist with more or less regularity between the harder, stronger rock substance over which the river rushes, forming savage rapids and furious cataracts down the steep slopes in its process of wearing back. From Napo to the Coca river, the stream is of a torrential character, bordered by high banks from which much coarse waste is received, giving rise to the formation of alluvial fans, which seem to impart to the river a tortuous course, or serve at other times to form the rapids of the more moderate slopes, choked with great tree-trunks and huge boulders, which add an embarrassing element to a most precarious navigation.

With competent Indians and good fortune, two days are consumed from Napo to Coca. Trouble began almost immediately with the first lot of Indians. Instead of getting others as previously agreed, an attempt to leave peremptorily was tried. Failing this, and compelled by the persuasion of firearms, at the end of three hours a new lot was obtained, escorted to the beach by the entire village. Not for long, however, for the same night they deserted to a man, or rather boy, for they seemed youths, one a mere child, but all very skilful in handling a canoe. They slipped away in the darkness, and the following day found me marooned in the forsaken village of Aguano. From here the descent was continued blindly and clumsily.

The river between the rapids seemed to consist of but two things, stagnant cul-de-sacs, or side channels always running into a bigger one at right angles, forming maelstrom-like pools, into which the canoe was hurled and thrown against and over the great snags of trees with which the river is filled. The numerous shifting channels are due to the formation of bars and islands of temporary existence owing to the narrow, steep flood plain. Each day of travel here was one of mishap, upset, physical injury, and worry. By the middle of the fourth day a spot known as Berna, two hours above the mouth of the Coca, was reached. It was named by a Swiss, who built himself a zinc roofed house of tropical requirements and modest dimensions; his

successor, a handsome young Italian, received me in a most kind and hospitable manner.

A short distance above Berna is the fall-line of the last rapids, the demarcation between the steeper slopes of older land of rock-formation to the weaker strata of the plain, for from this point the country is of the nature of a broad coastal plain of swampy formation, and heavily forested with a tropical growth. The fall-line is of interest from a historical point of view, as it must have been below this that Pizarro effected the construction of the brigantine. Santa Rosa is claimed by some as the spot, a village 80 miles below Napo village, and of very uncertain existence, for at times it flourishes, at other ceases to be. Above and below is impassable water for anything but a canoe; hence the most probable spot is the junction of the Napo and Coca rivers, or somewhere below.

From Coca to the Amazons the Napo flows through the flat, forested, swampy country in a series of great smooth curves or meanders, the outer plastic banks being continually cut away, involving destruction of trees, with the wrecks of which the river is at all times plentifully supplied, while the inner banks are filled to flood-level with sand or fine silted gravel, offering oftentimes capital beaches for camping and generous supplies of driftwood. The innumerable lakes bordering each side of the river open into the stream by sluggish little channels known as "coches," and the whole country is a *rete mirabile* of water-courses.

At Berna a rest was made to allow my feet to recover from inflammation from *merigui* flies and sloughing abscesses, left as reminders of the mountain journey, and the negro to recuperate from a rupture as best he could. On the 5th of September, in company with Roggerani, a dozen canoes, and some forty Indians, all on a long expedition of a year to the Tiputini for rubber, progress down the river was resumed. On the eve of the departure from Berna, a grand farewell feast or debauch was indulged in, consisting in an enormous consumption of *chicha*, the beating of drums, straggling processions, during the manœuvres of which flaming torches of cane were held aloft, lighting up and intensifying the weird scene. As morning approached the shrieking choruses gave way to single voices occasionally giving vent to wild, unearthly howls, which gradually died away. At the final leave-taking each squaw was presented by Roggerani with a nickel-plated spoon or a bauble to please her vanity, and gathering in groups upon the shore, with wails and lamentations, accentuated by swinging of arms, they bade adieu to their husbands and sons, who in return blew horns and fired off guns as the Napo current swept the canoe flotilla onward.

For five days we drifted on, sometimes the fleet together, at other times separated and lost to view from each other as the Indians went

off in search of prey. Henrico, an intelligent Indian, was the chief lieutenant of Roggerani's forces. On him devolved the responsibility of keeping the Indians sober and preventing their escape. As this may not be entirely clear, it is worth while here to say a word. A white man, usually Spaniard, Portuguese, or Italian, who establishes himself on any of the confluent branches of the Amazon for obtaining rubber, is known as a *cauchero*. His method of procedure is as follows. From any one of the established trading houses in Iquitos he takes out a credit, say £2000 worth of goods and supplies; he next establishes himself by one of the rivers in an Indian village or settlement, when he disposes of his wares to the Indians at a great profit. As payment, they give themselves, and pay off their debts by being the *cauchero's* slaves for the time being. If he wants rubber, many months are expended on long expeditions in quest of it. The best qualities are found on the hilly lands, which on the east side are the outlying foothills of the Andean system, where rise the headwaters of the smaller streams of the main arteries of the Amazon. Up these they go for weeks; then follow months of weary toiling through the forests on foot. If the expedition is a success the *cauchero* takes his rubber to Iquitos, either by means of the launches which now navigate many of the larger rivers, or transports it by canoe. By contract he is bound to deliver it, or at least an amount which equals the sum and interest of what he has borrowed from the trading house, they in turn disposing of it at profit to the large German houses in Mañaos and Para. In this simple scheme every one comes out well except the Indian. Sometimes the *cauchero* fails, either because his Indians run away after a little, or take fright at the attack of a savage band with their blow-gun (pucuna) made of a long straight piece of wood called chonta, a species of palm. This gun, usually about 8 feet long, and the curara arrow get the better of the miserable flimsy toy-like musket which is supplied to the members of the expedition, as is often the case. The arrow used is a slender stick almost a foot in length. It has a very sharp point dipped in poison, such as curara, while the end next the mouth is wrapped with the light, delicate wild cotton which grows in a pod upon the large silk-cotton so called. In shooting, both hands grasp the mouthpiece, and the guns are used with surprising dexterity, and they exhibit astonishing penetration at short distances. A joint of the bamboo serves as a quiver.

If the expedition is a failure, the *cauchero*, perhaps, is ruined financially. His creditors assume his debts, and since they are put to a little trouble, they immediately declare that instead of the Indians being responsible to them for £2000, they are now responsible for £3000, and must work off every penny of it in rubber operations, and a responsible white man goes to see that they do it. Sometimes in the battles of the rubber forests the savages come out second best. These Indians

represent an exceedingly low order of humanity. Speech is limited to a few signs; it is said they have a knowledge of counting up to five, corresponding with the five digits of the hand. They have a knowledge of fire, but eat their food raw. In captivity the mother expends no care on her offspring. Children are weaned on raw food, it is stated, and are bound to their captors or guardians until manhood is reached. Interesting specimens of this type are to be seen, their left cheek branded, which means slavery until maturity, in the majority of cases for life.

At noon a stop was usually made, the Indians chosen as hunters for that day bringing in wildfowl and monkeys, which, together with rice, yuca, and tea, furnished a splendid feast. Though the Napo has several varieties of monkey, the commonest is a large, heavy-boned one, with thick, coarse reddish hair, or more closely resembling the colour of iron-rust, except on the face, where it is black. Those measured were considerably over 2 feet from glabella to root of tail. To one hungry enough they are delicious eating, and the preparation is simple. The hair is singed off over a fire, the animal is then skinned, followed by decapitation and cut up, great pieces of steaks and limbs put into a good-sized pot and boiled. At night, about sundown, camp was made on some beach, fires lighted—extending for some distance along the shore—round which clustered groups of Indians, coarsely jesting among themselves while they tore off great snacks of monkey-meat, devouring voraciously, or beating each other with the bones; and as the tropical moon rose, the nightly concert from the opposite bank, furnished by the combined vocal efforts of pumas, wild hogs, monkeys, and macaws, would further accentuate the scene, weird enough already in the lurid light.

For several days below the Coca, a cone-shaped peak to the north-west looms up strangely like Cotopaxi; Orton states it is, but dwellers by the river deny this, and call it Sumaco. Late on the night of September 9, the junction of the Tiputini river with the Napo was reached. The Ecuadorian government has its last "politico tenienti" established here. From this point Roggerani's kindness and assistance was sadly missed. Aguarico river flows in a southerly course from the southern slope of the watershed which divides it from the head-waters of the Magdalena, and is of interest to-day as forming the natural boundary-line between Ecuador and Peru. None of the few maps in existence show this, but give Ecuador a much wider range, extending in many cases to the Amazons. This boundary question has been a bone of contention for years, Ecuador, after several unsuccessful attempts to establish a post below the Tiputini, has seemingly abandoned the idea, and each appears to tacitly agree upon the Aguarico.

From here down Peruvian characteristics manifest themselves.

Pottery, of which not a single piece is seen on the Napo above, now becomes most common in every Indian habitation, in the form of bowls and vessels. No wheel is used in the making, the designs are simple, and the colouring from delicate to deep reds. Each tribe adorns this pottery with a series of geometrical designs which show their respective family or tribe, much in the same way as the Alaskan adorns the totem. From the Aguarico to the Curaray, a big river which comes in from the west, it is a long, hard stretch, rendered doubly so by the absence of Indian assistance. The country here is particularly wild and desolate, and abounding in animal-life. The tall cane bordering the banks and forming a fringe to the dense forests furnishes a retreating ground for the pumas, jaguars, and herds of wild hogs, all of which seem to have an especial fondness for the river. Frequently in the afternoon pumas were met, swimming noiselessly up stream, and as many times as not when fired at the hogs dived, staying under water an incredibly long time. Enormous turtles were very common, and the beach for miles scratched with their imprints. Below the Curaray turtles and their eggs are one of the staple articles of food, as is monkey on the upper Napo.

For the last four days before the Curaray is reached, the Napo is filled with islands of all sizes, so grouped as to present narrow vistas or lanes of water, which open out after some miles into large lake-like bodies, or long open winding stretches, bordered with interminable reaches of beach and impenetrable jungles of cane, above which giant palms and silk-cotton trees raise themselves. Not a sign of human life is visible, and it is along this part that the Tambosoyacu, flowing from the north-east, gives itself over to the Napo. Just below the confluence of the Napo and Curaray is situated a large Indian settlement divided into two villages, from the first of which the timid inhabitants, after momentarily viewing from the bank the approach of the canoe, fled to the forest, leaving the village absolutely deserted; but a different reception was accorded at the lower one. The form of celebration common alike to either birth, death, or Sunday was in progress; as both first-named events had ensued within the preceding twenty-four hours, redoubled energy was being spent in the debauch, the yelling and wild shouts increasing each time the muttering thunder gave warning of the fast-approaching tropical storm. Spread over the floor of a huge bamboo house were the prostrate forms of men, women, and children; others lay helpless in the grass beneath; or drunken men, on either side of their still more drunken wives, some even with babies at their breasts, helped to support each other in reeling, staggering groups, cheered by the hoots and cries of the less inebriated. A Peruvian, with a fellow-white as lieutenant, resides as a government factor here, and was kind and hospitable in the most approved South American fashion. He had lost count of days and dates, but my diary

put him right after a discussion as to whether the day was Sunday or Tuesday.

Though the majority of white men here are of easy virtue, the Indian pursues a policy of monogamy, and wives are guarded with a truly surprising spirit of jealousy. The husband must always be spoken to first by a stranger; should the husband find the wife had conversed or held communication with one during his absence, he beats her. It is said this has arisen from Jesuit mission influence, teaching that the white man in general was the devil. It was told me that the Jesuits typified the evil white man as the blue-eyed Englishman, and the simple Indian, with the mind of a child, taking the idea literally, regards with disfavour, suspicion, and withal tremendous curiosity, any white individual who happens to have blue eyes. Judging from a curiously personal and unpleasantly close scrutiny to which I was subjected, first by the elders, then young men, women and children following last, all anxious to see, the blue eye of the Anglo-Saxon still has ascribed to it by the Napo communities the stigma of unjust suspicion and superstitious evil.

The Jesuits, as said before, at present are banished from the Napo, though it would seem as if they were more maligned than they deserved. A hard and trying field in which to work, with a curiously superstitious people, they laboured with a perseverance and an untiring energy which is most praiseworthy in view of the seeming hopelessness of their task. To-day no missionary movement is helping to raise the Napo Indian to a higher state of existence, yet it cannot be denied that other circumstances are curiously effecting a civilization. The Indian question is always an interesting one, and here, as elsewhere, the rule of destiny seems inexorable, the destruction of the Indian, but destruction not in the sense of annihilation, but of disappearance by being merged in the white race. That the process of evolution is slowly but surely being worked out no one can deny who has travelled through the domains of the Hudson Bay Company and seen the offspring of Scotch and Indian progenitors, where it is especially marked, or South America and observed the issue of fusing Spanish or Portuguese with Indian blood.

A strangely incongruous sight is to see an almost nude Indian woman using a sewing-machine, making calico dresses for her children, yet it is not an uncommon event. Even among those Indians who eat squatting on the floor, with fingers for forks, knives, and spoons, the sole article of household furniture may be a Pan-American or a New Haven sewing-machine, in which the female members take the greatest pride. The old Napo costume made out of woven grass or bark is now fast going out of fashion, more up-to-date dresses of cotton and linen being substituted, and a spirit of industry established. With their superstition is a blending of crude spiritualism, such as exists among primitive

races. The devil represents the entire quality of bad that exists, and this lurks in material forms, such as animals with horns, in consequence of which they utterly refuse to touch either cow or deer. They are firm believers in evil spirits, and they gather a special form of grass which they place in their houses at the time of any notable event. Girls marry very young, eleven or twelve being nothing unusual.

The Indians of the lower Napo paint themselves with a black pigment, and stain their finger-nails and teeth. Turtle-hunting is the occupation of many when not engaged in the quest for rubber. Among those small-pox seems to exist unceasingly. Each village had its patients, treatment consisting in isolation, aguandiente, and Perry-Davis painkiller, the last of which is used as extensively here as among the North American Indians.

The lower Napo abounds with the manitou, or sea-cow, great reddish-brown creatures, which follow the canoes for miles. The river is singularly free from alligators; only two rather small ones were seen during the entire time, though in the Ytaya and other small rivers emptying themselves into the Amazon in this same region, I saw large specimens and many of them.

At Mazan, an Indian settlement, two days distant from the south of the Napo descending, it was said that, by a portage of two hours through the forest, one could reach the Amazon, where plenty of Indians and canoes were to be had, by which the journey to Iquitos could be expedited in four days less time. The portage was easily carried out by nine Indians. This accomplished, I found myself marooned with an Indian woman, two small children, a boy just entering the convalescent stage of small-pox, my negro, and no provisions. From this unfortunate predicament, after several days, I was released, and continued the journey to Iquitos. The Mazan river, mapped as yet only by Orton, enters the Napo at Mazan from the west, and if Prescott is right topographically, this must have been the place where Pizarro and Orellana parted, one to retrace his steps by laborious marchings and inconceivable hardships to Quito, the other to drift onward down the unknown mighty Amazon to the Atlantic. Prescott states that Pizarro advanced to within two days of the great river. In reality, however, if this be so, he was within two hours, and had he pushed his way directly through the forest by the track now used occasionally by the Indians, to this rude soldier and bold adventurer there would have belonged the laurels of the discovery. To this day in Papallacta remain some curious skeleton-like forms of saddles, the parts Pizarro and his men did not eat on their return march. It is, however, difficult to distinguish between historical fact and fiction. The doughty Spaniards could never have advanced beyond Papallacta in the saddle, and to this point there would have been no difficulty as to provisions.

There has been hitherto some confusion in regard to the names Marãnon and Amazon, whether they were one and the same river, or if not where one ended and the other began. To the Brazilian and Peruvian voyageurs, the Amazon begins 100 miles above Iquitos, or where the Ucayali, flowing north-east, becomes confluent with the Marañon, which flows from the Adean slopes.

The Amazon is navigable for its entire length to ocean-going steamers, and river steamers experience no difficulty in going 1000 miles beyond, up the Ucayali, the whole a giant river system with unsurpassing possibilities, whose wonders are still to be known, of a continent as fascinating as it is strange and marvellous.

THE HYDROGRAPHY OF THE FAEROE-SHETLAND CHANNEL.

By H. N. DICKSON, M.A., B.Sc.

DURING the summer months of 1900, 1901, and 1902, the cutter-yacht *Walwin*, belonging to Dr. R. Norris Wolfenden, has been engaged in scientific research, under the owner's direction, in the channel between the Shetland and Faeroe islands. The physical investigations consisted in (1) observations of temperature, for which Negretti and Zambra's reversing thermometers, Knudsen's modified form of the same, and the ordinary Miller-Casella instrument, were employed, sometimes separately, usually together for purposes of control; and (2) the collection of samples of water by means of Mill's slip water-bottle. Dr. Wolfenden has been good enough to entrust the working out of the observations to me, and I may be permitted at the outset to express the opinion that the way in which they have been made, in a region where work of the kind is always difficult and arduous, and under conditions in many ways unfavourable, reflects the greatest credit on Captain Buchan Henry and his crew. The labours of the *Walwin* have provided a unique series of pictures of the conditions occurring in the channel, representing successive stages in the march of exceedingly complex phenomena with sufficient accuracy, and none of the modern expensive apparatus has been employed in the work, which was carried on from a small cutter of only thirty-six tons.*

* Some of the 1902 observations were made on the owner's second boat, the *Silver Belle*, a yawl of 130 tons. Dr. Wolfenden states that for all practical purposes the work is as easy to accomplish from the smaller boat. The larger the tonnage the greater the amount of wind required to sail the ship, and a good "sailing breeze" is often too strong for satisfactory working of the instruments.

Table I. gives the characteristic numbers and the positions of the stations at which observations were made.

Table II. gives the temperatures observed. Where the observations were made with more than one instrument, the mean result is given; the differences rarely amounted to more than a few tenths of a degree Fahrenheit. The original readings were made according to the Fahrenheit scale, and their consistency tested in the usual way by plotting curves. It has been thought best to convert them to the centigrade scale, in which all the observations in the region already published are given, and which is being employed in the International investigations.

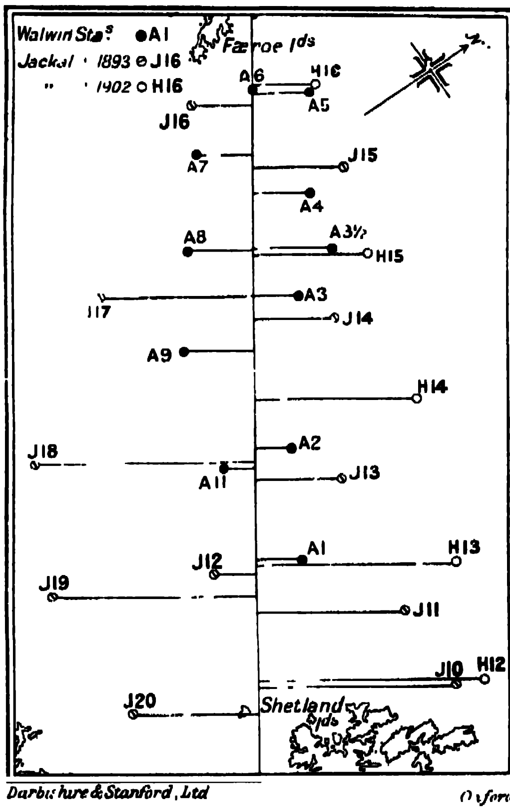


FIG. 1.—MAP SHOWING POSITIONS OF STATIONS AND LINE OF SECTION.

Table III. gives the salinities of the samples collected. The chlorine titrations were carried out for me by Mr. J. J. Manley, Magdalen College Laboratory, Oxford, and my best thanks are due to him for his

assistance. The salinities were originally obtained from the chlorines by the use of the table which I published in the Report of the Fishery Board for Scotland (No. 12, 1893, p. 381). They have since been compared with Knudsen's authoritative tables, issued recently; the differences were insignificant. I am indebted to my friend, Mr. O. J. R. Howarth, for assistance in reducing, tabulating, and plotting the results.

In arranging the material for discussion and comparison with other observations, the first point to be noted was that the most important series (and the only ones dealt with here) consist of nearly parallel double lines of soundings, one line starting from near the north end of the Shetlands, and another from near the south end, and both extending to the Faeroes. An examination of all the *Walwin's* observations, of the observations made by the *Jackal* in the cruise of 1893, and again by the *Jackal* in 1902 (see Helland-Hansen in *Nature*, vol. 66, p. 654), indicated that these lines were so close together that they could for all practical purposes be regarded as one and the same. Two points, in positions (approximately) 59° 56′ N. lat., 1° 24′ W. long., and 61° 45′ N. lat., 6° 48′ W. long., were accordingly selected, and joined on the chart by a straight line to which perpendiculars were drawn from the stations (Fig. 1). All the observations were then plotted upon vertical sections along that line. The method is no doubt open to criticism, but the errors introduced cannot exceed the errors incidental to the observations, and it makes the most of the available material.

In the result, we have from the *Walwin's* observations sections for the following dates:—

July, 1900.
May–June, 1901.
June–July, 1901.
May, 1902.
June, 1902.
July, 1902 (temperature only).

To these may be added, completing the existing record:—

Jackal, August, 1893,
,, (preliminary report only), August, 1902,

making eight more or less complete pictures in all (Figs. 2 to 9).*

In the Faeroe-Shetland channel we have to deal with the opposing movements of water from the south and from the north. The northward-moving currents are of two kinds, (*a*) drift currents,

* In these sections the Shetland end of the line is on the right, the Faeroe end on the left.

produced at the surface by the winds in the locality; and (*b*) a stream current, which I have (*Phil. Trans. A.*, vol. 196, p. 113) proposed to call the Norwegian branch of the European stream. This branch forms part of a stream current relieving the water banked up against the continental mass by the westerly winds; it varies in strength from year to year and from season to season, and its salinity also varies slightly, a high salinity probably indicating a large proportion of gulf-stream water, and a low salinity a large proportion of water from the Labrador current and the northern area of the Atlantic. Direct observations in the depth are still wanting, but the range of salinity may be estimated at from 35·4 per mille to 35·7 per mille. The southward-moving currents are also of two kinds, (*c*) water from the central and western parts of the Norwegian sea, most of which has probably originated in the area east and north-east of Newfoundland and been carried across as a drift, mixing with the "Irminger" and "Greenland" branches of the European stream. If the European stream is below its normal strength, it seems likely that this body of water will attain unusual volume, and part of it will try to make its way southward. The comparatively cold salt water observed by the *Jackal* in 1893 (station VIII.), and again by Helland-Hansen in the *Jackal* in 1902 (*Nature, loc. cit.*), in the north-western part of the North sea, is probably to be identified with it, as Helland-Hansen suggests, and it seems likely that the importance of this factor has been under-estimated by the earlier investigators, especially, perhaps, in my report on the work of the *Jackal* in 1893. The second body of southward-moving water (*d*) is that derived from the melting of ice in the Arctic regions. This water is probably spread over the surface in summer and autumn, and makes its way southward to the east of Iceland and the Faeroe islands. So far as the region under discussion is concerned, it may probably be assumed that the water from the centre of the Norwegian sea (*c*) has a salinity of 35 per mille to 35·3 per mille, and that a salinity of less than 35 per mille indicates a large admixture of water of Arctic origin (*d*).

The difficulty of interpreting the sections across the Faeroe-Shetland channel in the light of the above is immensely increased by the fact that the line of section lies just in the region where the waters from the sources mentioned meet and mix, and that we have no simultaneous observations in the regions of origin. The difficulty is specially apparent in studying the distribution of temperature, for, unlike salinity, temperature may change without movement or mixture of the waters. The most important point is evidently to note that when the circulation is active, isothermals and isohalines are crowded together, showing strong gradients of temperature and saltness, while weak gradients are an indication of weak circulation, the waters moving slowly and being very completely mixed.

The general conditions controlling the movement and mixture of waters are : (1) the Norwegian stream (*b*) is cut off below by the Wyville-Thomson ridge at a depth of about 300 fathoms—north of the ridge its waters are mixed with ice-cold water of slightly lower salinity drawn up by the "undertow" to an amount depending partly on the velocity of the stream, and increasing with it (see 'Twelfth Report of the Fishery Board for Scotland,' p. 351); (2) the drift current (*a*) and the European stream are independent of one another, but where the former exists, *i.e.* as a northward-moving current, the waters of (*a*) and (*b*) are likely to be indistinguishable by means of either temperature or salinity observations; (3) the southward-moving waters (*c*) and (*d*) may be independent, and they may or may not be fully mixed before entering the Faeroe-Shetland channel; (4) when the northward-moving currents are strong, they will tend to be surface currents, because of the relatively high temperature of the waters. When they are weak, their waters will be cooled by contact and mixture with the cold underlying waters. The southward-moving waters will tend to be under-currents because of their low temperature, and will only rise to the surface when they are exceptionally strong relatively to the northward-moving currents, or when they contain an unusually large proportion of, on the one hand, warm Norwegian sea-water, or, on the other, fresh Arctic water.

Taking now the sections in order, the first is that for August, 1893, based on the *Jackal* observations. In the report on these observations I expressed the opinion (p. 352) that the conditions were there "favourable to an increase of the Atlantic current," but at the same time it was noted (p. 337) that during the observations the navigating lieutenant of the ship found "a southerly drift amounting to approximately 10 miles in twenty-four hours." With the information available at the time as to the sources from which the waters were derived, it was impossible to identify clearly all the factors involved, or to give a complete explanation of the movements going on. I had to content myself with an attempt to discuss the mechanism of the process of mixture of the northward and southward moving waters, on the assumption that the former (*a* and *b*) were one, and the latter (*c* and *d*) one. The difficulties which arose led me to undertake an investigation of the movements of surface waters in the North Atlantic, and as a result, to separate the stream current (*b*) from the surface drift (*a*); the resolution of the southward-moving waters into (*c*) and (*d*) is chiefly the result of the observations of the *Ingolf* expedition (1896) and of Prof. Pettersson's discussions. In the light of these more recent conclusions it appears from the section (Fig. 2) that in August, 1893, the Norwegian stream was running strongly northward, its main centre lying on the eastern side of the channel at a depth of about 80 fathoms, while its waters extended nearly to the Faeroe islands. The cold bottom water, which shows no

marked tendency to rise towards the surface, was entirely cut off from a thin layer of relatively fresh surface water (salinity below 35·3), which covered the whole surface of the channel to a depth of a few fathoms, and near the Shetlands extended to the bottom. This layer was probably, as Helland-Hansen has suggested, water from the Norwegian sea (c), rather than a mixture of it with water which had come from the south through the Faeroe-Shetland channel, as I supposed at the time. Its southward movement would account for its appearance at station VIII. in the north-west of the North sea,

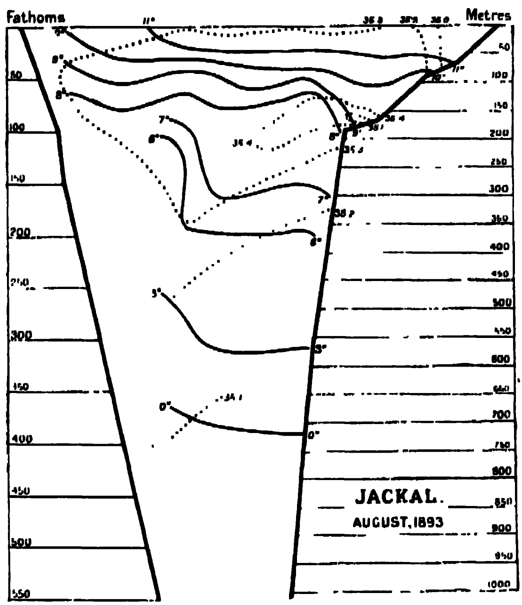
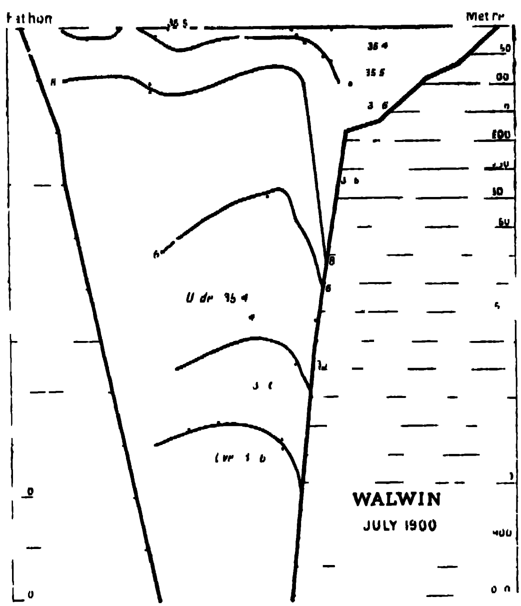


FIG. 2.—FAEROE-SHETLAND CHANNEL. TEMPERATURE AND SALINITY, AUGUST, 1893. H.M.S. *JACKAL*.

referred to above, and for the southerly drift of the *Jackal* during the observations.

The section for July, 1900 (Fig. 3), shows a state of affairs so remarkable that if it were possible to doubt the accuracy of the observations, one would be almost inclined to take refuge in doing so, but the complete consistency of four sets of soundings makes the supposition unreasonable. Salinity is at all depths remarkably high, scarcely falling anywhere below 35·4. At a depth of 400 fathoms, *i.e.* 100 fathoms below the Wyville-Thomson ridge, is a maximum of salinity of 35·6, in water *having a temperature of melting ice.* Above this is a mass of water of salinity about 35·4, the minimum occurring with low temperature

near the middle of the channel in about 250 fathoms. Above this, again, the saltest (35·6) and warmest water lies on the east side of the channel, although close to the Shetlands salinity falls again near the surface. This extraordinary distribution seems to indicate that at an earlier date than that of the section, probably in the previous winter, there had been a strong movement of very salt water from the Norwegian stream and surface drift (*a* and *b*), which from some external cause afterwards failed. Below 300 fathoms the water, protected by the Wyville-Thomson ridge, remained stationary, and was gradually cooled down to 0° C by contact and slight mixture with the



—FAEROE SHETLAND CHANNEL TEMPERATURE AND SALINITY, JULY, 1900
YACHT *WALWIN*

water lying under it. Above 300 fathoms a southward movement probably set in, lowering both temperature and salinity, and this was followed, probably just before the date of the section, by a re-establishment of the Norwegian stream (*b*) in full force, the water being somewhat salter, but the stream in almost the same position as in 1893 (Fig 2).

The season 1901 is represented by two sections (Figs 4 and 5); the observations forming the first were made between May 14 and June 4, those forming the second between July 4 and July 16. Thus the middle dates are May 24 and July 10, and a comparison is of particular interest,

because these are the first sets of observations which have been made in this area at dates close enough to admit of direct comparison, or to give any idea of the rate at which changes occur. In both sections nearly the whole channel is filled with water of 35·5 salinity or over, and in the depth temperature is low. The freshest water (35·3) appears on the east side of the channel at a depth of 380 fathoms, apparently indicating an intrusion of deep water from the Norwegian sea into a mass of Atlantic water, which had been cooled down in the same way as in the previous years. It is to be observed that this centre of low salinity is also one of low temperature, the readings at 300 and 400 fathoms rising

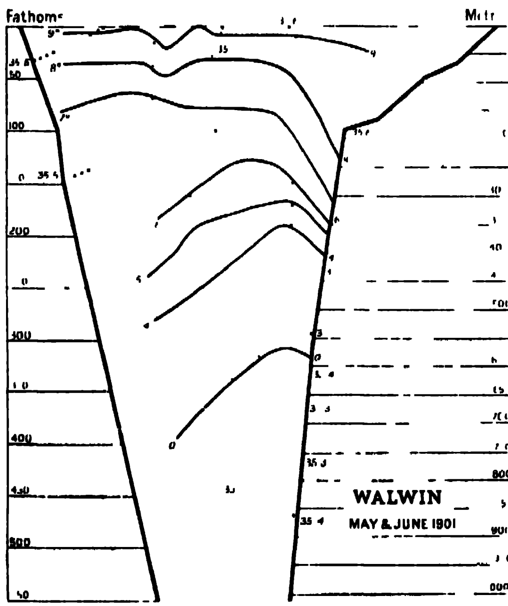


FIG 1.—FAEROE-SHETLAND CHANNEL TEMPERATURE AND SALINITY, MAY AND JUNE, 1901. YACHT *WALWIN*.

from east to west. All the western side of the channel is occupied by water of 35 5 salinity. In the strata nearer the surface we find the first indication of the features so strongly marked in 1902, in which the saltest and warmest waters appear as two branches, one a little to the west of mid-channel, and another on the east side, close to the land. In the interval between May 24 and July 10 the distribution in the depth seems to have become more uniform. In the depth the centre of low temperature and salinity on the east side has disappeared, and apparently the whole breadth of the channel is occupied by water of about 35·4 salinity. In the upper layers the two branches of warm

salt water are further apart at the surface, the western member is more strongly marked, while at intermediate depths (100 to 300 fathoms) salinity has increased slightly on the east side, and diminished on the west. The differences point in effect to a strengthening of both the northward and southward moving streams above 300 fathoms, the latter keeping to the west, while the former keeps to the east, but sends a narrow branch, 50 to 60 fathoms deep, along the western side. It is noteworthy that there is no indication of a southward movement of fresher water towards the Shetlands.

For the year 1902 we have four sections (Figs. 6 to 9), the middle

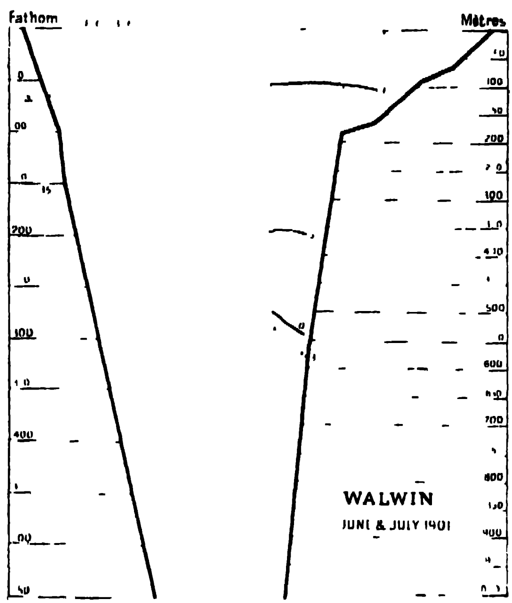


FIG. 5.—FAEROE-SHETLAND CHANNEL. TEMPERATURE AND SALINITY, JUNE AND JULY, 1901. YACHT *WALWIN*

dates being May 24, June 24, July 21, and August 29. Some are, of course, incomplete, and salinity observations are wanting for the July section, but it seems possible to follow the course of events with considerable certainty.

In the May section the first point to be noticed is the remarkably low temperature and salinity in the depth. Up to within 200 fathoms of the surface the salinity is about 35·2, slightly higher on the east side and lower on the west, while at that depth the temperature is only 2°. Nearer the surface the northward flow of water is apparent, the salinity rising above 35·6 in warm water on the east side, and scarcely

falling below 35 5 on the west. In June it appears that the northward movement had ceased altogether, and that a southward set at all depths has begun, except on the west side of the channel, within about 100 fathoms of the surface, where the conditions remain practically unchanged. The surface salinity is now almost uniformly 35·4, and in the depth the isohalines of 35 2 and 35·1 appear to have moved eastwards. Temperature has fallen at the surface, become more uniform down to the 100-fathom line, and fallen at 400 and 500 fathoms. The June observations reveal for the first time, observations being wanting for May, a steep gradient of temperature on the east side between

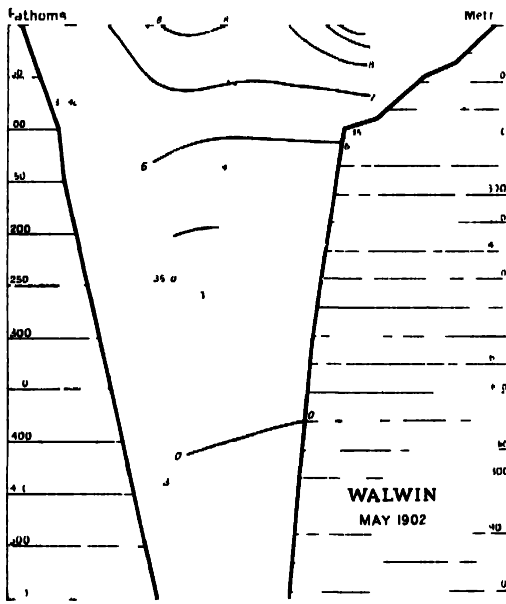


FIG. 6.—FAEROE SHETLAND CHANNEL TEMPERATURE AND SALINITY MAY, 1902 YACHT *WALWIN*

100 and 200 fathoms. The 2° reading at station A3 at 200 fathoms in May makes it likely that a similar distribution existed during that month.

In the July section the form of the isotherms shows a further advance of cold water in the depth. Temperature has fallen generally, and a wedge of cold water near station A8 rises almost to the surface. On either side of this, warm water, possibly parts of northward-moving streams, extends down to something like 150 fathoms. In the August section, drawn from the observations of H.M.S. *Jackal* published in *Nature*, the cold wedge shows still further advance, and its summit

has shifted more into the centre of the channel. The low salinity at all depths is quite the most remarkable feature of the section, indicating an unusually large proportion of water of Arctic origin in the Norwegian sea. This water appears to be moving southwards in mid-channel, both at the surface and in the depth, a slight weakening being apparent between 50 and 100 fathoms, where the salinity rises above 35·1. On the western side the increase of salinity is so slight as to make it doubtful if any northward movement is taking place, it seems more likely that the 35·4 water observed there in June is merely undergoing mixture with the fresher water, a view supported to some extent by its

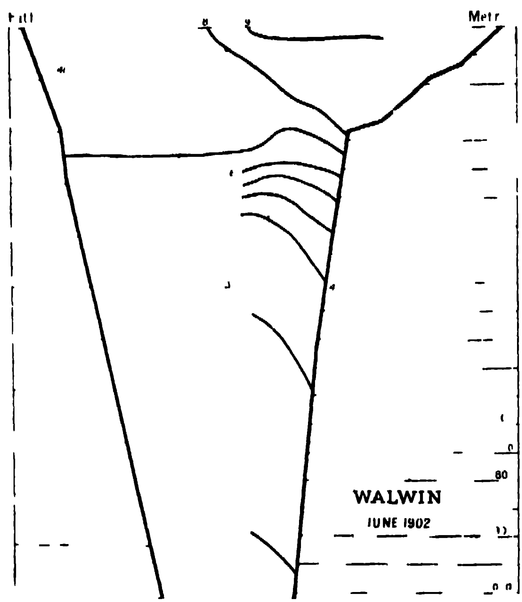


FIG 7 — FAEROE-SHETLAND CHANNEL TEMPERATURE AND SALINITY JUNE, 1902 YACHT WALWIN

steady temperature. A northward movement is, however, apparent on the eastern side, where the temperature is relatively high, and the salinity rises above 35 4.

We may summarize these results as follows —

1899 —Both northward and southward moving streams strong The Norwegian stream occupied most of the channel in the intermediate depths, below it water was moving southwards, and on the surface a thin layer also moved southward; this layer became thicker on both sides, and near the Shetlands extended to the bottom.

1900.—The whole channel is occupied by water from the south, northward movement having apparently been strong earlier in the

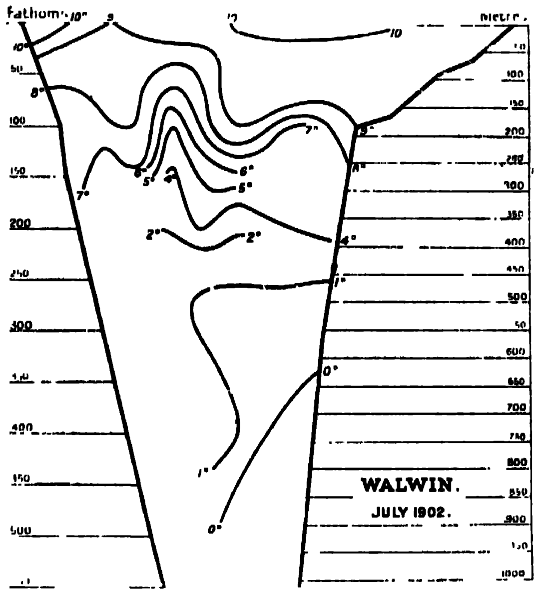


FIG. 8.—FAEROE-SHETLAND CHANNEL. TEMPERATURE AND SALINITY. JULY, 1902. YACHT *WALWIN.*

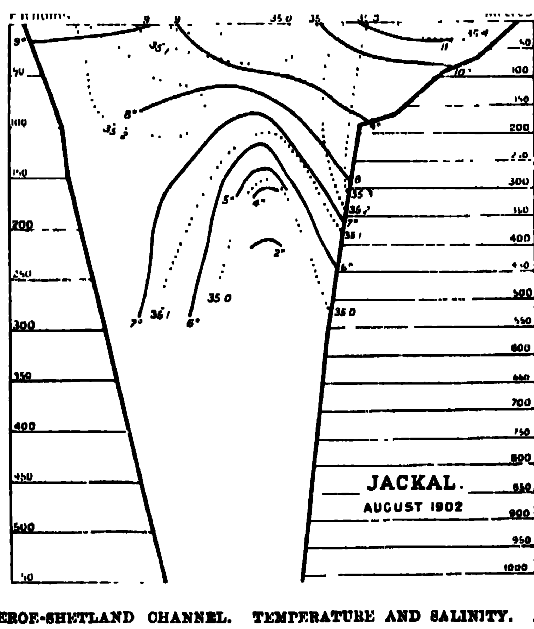


FIG. 9.—FAEROE-SHETLAND CHANNEL. TEMPERATURE AND SALINITY. AUGUST, 1902. H.M.S. *JACKAL.*

season. At the date of the observations (July) little movement was in progress, but there are indications of intrusion of water from the north at a depth of about 300 fathoms, and at the surface on the east side.

1901.—There are indications of feeble southward movement in the depth, but most of the channel is occupied by water which has come from the south. A weak northerly movement is apparent near the surface, with some tendency to split into two branches, one west of mid-channel, the other near the east side.

1902.—Unusually cold fresh water filled the channel, at all depths below 150 fathoms, throughout the season. In May the surface waters were of southern origin, and were moving northward, but as the season progressed, southward movement increased both at the surface and in the depth, especially in mid-channel, the waters mixing with and driving out those of southern origin on each side. That this movement extended far to the southward is shown by the fact that an ice-floe was met with during July off the Treshinish islands, on the west side of Mull. The summer of 1902 was one of the worst on record in the Faeroe-Shetland channel, and hydrographical work was exceedingly difficult.

A comparison of the 1902 sections with the admirable charts of surface temperature published as insets in the British 'Pilot Chart of the North Atlantic,' shows in the clearest manner the relation between the surface movements in the open ocean and the currents in the channel. In May the surface temperature was normal, or slightly below it, between the west coast of the British Isles and about long. 15° W. Further west, and to the north-west, there was a narrow band of water above the normal temperature, obviously supplying the water which was going northward on the east side of the channel. In June temperature was apparently below the normal over the whole of the surface of the eastern Atlantic, and in the subsequent months the area of low temperature gradually narrowed, until in October it had entirely disappeared.

I hope to obtain data with regard to atmospheric pressure, similar to those embodied in the Pilot Chart for October, for the earlier months, and to discuss their relation to the observations in the Faeroe-Shetland channel in a later paper. The Pilot Charts in their present form will be an invaluable help in interpreting the observations to be made under the international scheme, and, as Dr. Wolfenden informs me that he intends to make simultaneous observations at depths down to 1000 fathoms to the west of Ireland, the mechanism of the currents flowing from the central region should be completely and finally determined.

The conclusions arrived at up to the present may be stated thus:—

1. Northward movement of water originating as a *drift* current is strongest in the Faeroe-Shetland channel during winter.

2. Northward movement of water originating as a *stream* current is strongest in summer, being probably due to the extension of the "Atlantic anticyclone."

3. The northward movement 2 is the more uncertain, and varies most in different years.

4. In the transition stages between 1 and 2, or when 2 is abnormally weak, the water in the Faeroe-Shetland channel may remain practically motionless for extended periods. If the channel is filled with water from the south, this water will gradually cool down and sink, being cooled by, and mixing with, the cold underlying waters.

5. To the north of the Faeroe-Shetland channel the waters of the Norwegian sea consist of a mixture of waters of Arctic origin with those of Atlantic origin, the latter very similar to 1. The mixture is in most cases fairly complete, but during summer water of Arctic origin, set free by the melting of ice, may form a surface layer of considerable thickness.

6. The waters of the Norwegian sea make their way southward, under favourable conditions, into the Faeroe-Shetland channel and the North sea. The entrance to the North sea is probably effected every year, as there is no opposing northerly current on the western side. In the Faeroe-Shetland channel the southward movement is normally prevented by the northerly currents 1 and 2, except at depths below 300 fathoms, where the northward currents are cut off by the Wyville-Thomson ridge, and at the surface, where there may be a southerly drift current. In exceptional cases, as in 1902, the northerly movement may be in abeyance, and water may move southward at all depths. It seems likely that the presence of this water in the North sea has a special bearing on biological and fishery questions.

7. The movements of the surface waters of the sea and the temperature of the air near the British Isles do not stand in any direct relation of cause and effect. Northerly winds bring cold weather, and by drifting and "banking" cold water from higher latitudes, bring cold surface water with them. Southerly winds bring warm weather, and bring warm water from low latitudes in the same way. The temperature of the surface water in the open sea influences the distribution of atmospheric pressure, as Pettersson has shown, and it will therefore affect the direction of the prevailing winds, but motion has nothing to do with this influence.

TABLE I.*

List of "Walwin" Stations.

Station.	Lat. N.	Long. W.	Station.	Lat. N.	Long. W.
	° ′	° ′		° ′	° ′
A1	60 40	2 50	A10	60 17	3 5
A2	60 54	3 40	A11	60 27	3 50
A3	61 16	4 41	B1	60 51	6 22
A3½	61 28	4 50	B2	60 17	6 22
A4	61 32	5 20	B3	59 46	6 20
A5	61 45	6 02	B4	60 00	5 20
A6	61 31	6 20	III.	Off Fitful Head.	
A7	61 14	6 08	IV.	West of Yell sound.	
A8	61 00	5 30	V.	Off Flugga L. H	
A9	60 45	4 50	VI.	East of Bressay.	

TABLE II.

Temperature Observations.

Date.	Position	Depth. fath	Depth. m.	Temp. C.
1899.				
July 1	8 miles off Hoy Hd.	0	0	10·6
,,	,,	30	55	10·0
,,	N. of Westray ...	0	0	10·6
,,	,, ...	40	73	10·6
,,	S.W. of Sumburgh Hd.	0	0	9·7
,,	,,	65	119	8·9
,, 3	N.W. of Yell sound	0	0	11·7
,,	,,	50	91	10·8
,,	N.E. of Lamba Ness	0	0	11·7
,,	,,	55	101	9·1
,, 4	E. of Bressay ...	0	0	12·2
,,	,, ...	55	101	8·1
,,	E. of Fair Isle ...	0	0	10·0
,,	,,	60	110	8·6
,,	E. of Copinshay ...	0	0	10·6
,,	,,	43	79	8·9
Oct. 14	8 miles off Hoy Hd.	0	0	10·6
,,	,,	40	73	11·1
,, 21	Station IV. ...	0	0	9·4
,,	,, ...	59	108	10·6
,, 23	Station V. ...	0	0	9·7
,,	,, ...	55	101	10·8
,, 27	Station VI. ...	0	0	9·4
,,	,, ...	52	95	11·1
Nov. 10	Station III. ...	0	0	7·2
,,	,, ...	55	101	8·1
,, 25	Station IV. ...	0	0	6·9
,,	,, ...	60	110	9·1
,, 27	Station V.... ...	0	0	8·3
,,	,, ...	52	95	9·2
Dec. 3	Station VI. ...	0	0	7·2
,,	,, ...	50	91	8·9
,, 5	Station III. ...	0	0	6·7
,,	,, ...	55	101	8·9
1899.				
Dec. 15	Station IV. ...	0	0	6·9
,,	,, ...	40	73	8·6
,, 18	Station V. ...	0	0	7·2
,,	,, ...	56	102	8·6
1900.				
Jan. 1	Station VI. ...	0	0	7·2
,,	,, ...	52	95	7·8
,,	Station III. ...	0	0	7·5
,,	,, ...	59	108	8·1
,, 30	Station IV. ...	0	0	7·5
,,	,, ...	53	97	8·1
Feb. 9	Station V.... ...	0	0	7·2
,,	,, ...	54	99	7·5
,, 14	Station VI. ...	0	0	6·1
,,	,, ...	46	84	6·9
,,	Station III. ...	0	0	5·8
,,	,, ...	61	111	6·7
Mar. 1	Station IV.	0	0	5·0
,,	,, ...	58	106	5·8
,, 3	Station V.... ...	0	0	6·1
,,	,, ...	53	97	6·4
,, 1	Station VI. ...	0	0	6·1
,,	,, ...	59	108	6·1
,, 6	Station III. ...	0	0	6·1
,,	,, ...	70	128	6·1
,, 23	Station IV. ...	0	0	6·1
,,	,, ...	55	101	6·1
,, 24	Station V.... ...	0	0	5·8
,,	,, ...	47	86	6·4
,, 27	Station VI. ...	0	0	5·0
,,	,, ...	50	91	5·8
,, 30	Station III. ...	0	0	4·4
,,	,, ...	64	117	5·6
Apr. 21	Station IV. ...	0	0	6·7
,,	,, ...	53	97	6·4

* For numbers and positions of the *Jackal* stations in 1898 and 1902, see 'Twelfth Report of the Fishery Board for Scotland,' p. 364, and *Nature*, vol. 66, p. 654.

Date.	Position.	Depth. fath.	Depth. m.	Temp. C.
1900.				
April 22	Station V.... ...	0	0	6·7
"	"	54	99	6·7
" 24	Station VI. ...	0	0	6·4
"	"	65	119	6·4
" 27	Station III. ...	0	0	5·8
"	"	65	119	5·8
May 24	Station V. ...	0	0	8·1
"	"	54	99	7·2
" 25	Station IV. ...	0	0	8·6
"	"	64	117	7·2
" 26	Station III. ...	0	0	6·9
"	" ...	66	121	6·4
June 9	17 miles W.N.W. of Flugga L. H.	0	0	8·4
"	"	66	121	8·1
"	6 miles off Yell sound	0	0	8·1
"	"	55	101	7·2
" 12	Station IV. ...	0	0	10·0
"	"	72	132	8·6
" 13	10 miles S.S.W. of IV.	0	0	9·2
"	"	60	110	7·8
"	Station III. ...	0	0	8·6
"	"	62	113	7·5
July 11	Station A1... ...	0	0	13·3
"	"	50	91	11·1
"	"	100	183	10·6
"	"	150	271	9·4
"	Station A2 ...	0	0	11·1
"	"	50	91	7·2
"	"	100	183	7·2
" 12	Station A3 ...	0	0	11·1
"	"	50	91	8·1
" 13	Station A4 ...	0	0	10·3
"	"	50	91	7·9
"	"	93	170	7·2
"	Station A5 ...	0	0	11·1
"	"	50	91	7·9
"	"	84	154	7·9
" 21	Station A6 ...	0	0	10·6
"	"	100	183	8·1
"	Station A7 ...	0	0	10·6
"	"	50	91	8·1
" 22	Station A8 ...	0	0	11·4
"	"	100	183	7·8
"	"	350	640	0·6
" 23	Station A9 ...	0	0	11·7
"	"	100	183	8·9
Aug. 28	10 miles N.E. ½ N. from Station A1	0	0	12·2
"	"	50	91	9·4
"	"	100	183	9·2
"	"	200	366	8·4
"	"	280	512	7·8
"	20 miles N.N.E. of Station A1	0	0	12·2
"	"	80	146	9·1
"	"	150	274	8·4
"	"	250	457	6·1
"	"	350	640	−0·6
" 29	Station A2 ...	0	0	11·4
"	"	50	91	8·5
"	"	100	183	7·1
"	"	200	366	5·8
"	"	300	549	1·0
"	"	400	732	0·0
1900.				
Aug. 29	Station A2 ...	500	914	−0·7
Oct. 4	Station III. ...	0	0	9·4
"	"	70	128	10·0
" 10	Station IV. ...	0	0	10·0
"	"	75	101	10·6
" 16	Station V.... ...	0	0	8·9
"	"	75	137	10·0
" 19	Station VI. ...	0	0	10·0
"	"	57	104	10·0
1901.				
Jan. 12	Station IV. ...	0	0	7·8
"	"	62	113	7·8
" 19	Station V.... ...	0	0	7·2
"	"	55	101	7·8
Feb. 2	Station VI. ...	0	0	6·1
"	"	60	110	7·2
"	Station III. ...	0	0	5·6
"	"	62	113	6·7
May 14	Station A1 ...	0	0	9·7
"	"	114	209	8·6
" 15	Station A2 ...	0	0	9·2
"	"	45	82	7·4
"	"	100	183	6·1
"	"	200	366	3·0
"	"	300	549	0·1
"	"	400	732	−0·6
"	"	500	914	−1·0
" 21	Station A3 ...	0	0	8·9
"	"	45	82	7·3
"	"	100	183	6·8
"	"	200	366	4·7
"	"	300	549	1·2
"	"	400	732	−0·2
"	Station A4 ...	0	0	8·9
"	"	45	82	7·5
"	"	115	210	6·7
"	"	120	220	6·7
"	Station A5 ...	0	0	8·9
"	"	90	165	6·7
" 29	Station A6 ...	0	0	9·2
"	"	45	82	7·5
"	"	100	183	6·8
"	"	145	265	6·7
"	"	150	274	6·7
"	Station A7 ...	0	0	9·2
"	"	45	82	7·8
"	"	80	146	6·7
"	"	135	247	6·7
June 3	Station A8 ...	0	0	10·4
"	"	45	82	8·1
"	"	100	183	6·7
"	"	200	366	5·7
"	"	255	467	4·2
"	Station A9 ...	0	0	10·8
"	"	45	82	7·5
"	"	100	183	6·4
"	"	200	366	4·7
"	"	300	549	0·8
"	"	400	732	−0·3
" 4	Station A11 ...	0	0	10·6
"	"	50	91	8·9
"	"	100	183	8·4
"	"	200	366	8·1
" 19	Station A1 ...	0	0	9·7
"	"	50	91	9·0
"	"	100	183	8·4
"	"	110	201	8·4

Date.	Position.	Depth fath	Depth m	Temp C.
1901.				
June 20	Station A2 ...	0	0	10·0
"	"	45	82	9·1
"	"	100	183	8·5
"	"	200	366	4·4
"	"	300	549	0·1
"	"	400	732	−0·3
"	"	500	914	−0·7
July 27	Station A1 ..	0	0	12·5
"	"	45	82	9·4
"	"	80	146	8·9
"	"	130	238	8·6
"	Station A2 ...	0	0	12·2
"	"	45	82	9·2
"	"	100	183	7·8
"	"	500	914	−0·7
1902				
May 17	Station A1 ...	0	0	10·8
"	"	100	183	6·1
" 18	Station A2 ...	0	0	7·8
"	"	400	732	−0·1
"	"	500	914	−0·6
"	"	608	1112	−1·1
" 20	Station A3 ...	0	0	8·4
"	"	50	91	7·2
"	"	100	183	6·1
"	"	200	366	1·9
"	"	300	549	0·6
"	"	400	732	0·2
" 21	Station A1 ...	0	0	7·2
"	"	50	91	6·7
"	"	108	198	6·7
June 1	Station B3 ...	0	0	8·6
"	"	50	91	8·4
"	"	100	183	7·2
" 19	Station A1 ...	0	0	9·2
"	"	110	201	7·8
" 21	Station A2 ...	0	0	8·4
"	"	200	366	3·9
" 22	Station A3	0	0	7·8
"	Station A1	0	0	7·9
"	"	50	91	7·5
"	"	110	201	7·2
"	Station A5	0	0	8·1
"	" .	55	101	7·2
" 26	Station A6	0	0	8·6
"	"	110	201	7·2
" 27	Between A7 and A8	0	0	8·9
"	"	155	281	6·7
" 28	Between A2 and A9	0	0	9·4
"	"	50	91	7·8
"	"	100	183	7·2
"	"	200	366	2·8
"	"	300	549	0·6
"	"	400	732	−0·3
"	"	500	914	−1·1
"	Station A2 .	0	0	9·4
"	"	50	91	8·1

Date.	Position.	Depth. fath	Depth. m.	Temp C.
1902.				
June 28	Station A2	100	183	6·7
"	"	200	366	1·4
"	"	300	549	1·1
"	" ...	400	732	−0·6
"	"	500	914	−0·7
"	"	600	1097	−1·1
" 29	Between A1 and A10	0	0	9·4
"	"	120	220	8·9
July 9	6 miles inside A1	0	0	10·0
"	"	80	146	8·4
" 15	Station A2	0	0	10·0
"	"	50	91	7·8
"	"	100	183	6·7
"	"	200	366	3·9
"	Station A3	0	0	9·4
"	"	50	91	7·8
"	"	100	183	6·7
"	"	200	366	3·9
" 16	Station A4	0	0	9·4
"	"	120	220	7·2
" 17	Station A5	0	0	8·4
"	"	75	137	7·8
" 20	Station A6	0	0	10·6
"	" ..	120	220	7·8
"	Station A7 ..	0	0	8·9
"	"	120	220	6·9
" 21	8 miles E. of A8	0	0	9·7
"	"	50	91	7·2
"	"	100	183	5·0
"	"	200	366	1·9
"	"	260	476	1·1
"	Station A9	0	0	10·0
"	"	50	91	9·4
"	"	100	183	8·9
"	"	200	366	2·2
"	"	400	732	1·1
"	"	500	914	−0·6
" 22	11 miles S. of A11	0	0	10·6
"	"	80	146	8·9
"	Station A10 .	0	0	9·1
"	"	80	146	8·6
Aug. 1	17 miles off Foula	75	137	8·1
"	Station A1 .	0	0	11·4
"	"	110	201	8·9
" 3	10 miles S. of A2	0	0	10·6
"	"	100	183	6·7
"	"	200	366	3·9
"	"	300	549	0·3
"	"	400	732	−0·6
"	"	500	914	−1·1
" 5	10 miles S. of A9...	0	0	10·7
"	"	200	366	8·[illegible]
"	"	400	732	0·[illegible]
"	"	500	914	−0·[illegible]
"	Station B1 ...	0	0	11·7
"	"	150	271	9·[illegible]
"	"	260	476	8·4

TABLE III.

Salinity Observations

No. of sample	Date	Position	Depth fath	Depth m	Cl.	Salinity per mille
	1900.					
1	May 24	V.	0	0	19·59	35·40
2	,, 25	IV.	0	0	19·67	35·54
3	,, 26	III.	0	0	19·66	35·52
4	June 3	III.	0	0	19·63	35·47
5	,, 12	IV.	0	0	19·66	35·52
6	,, 15	III.	0	0	19·77	35·72
7	July 11	A1	0	0	19·58	35·38
8	,,	,,	100	183	19·74	35·66
9	,,	,,	150	274	19·67	35·54
10	,,	A2	400	732	19·70	35·59
11	,,	,,	500	914	19·67	35·54
12	,, 12	A2	0	0	19·65	35·50
13	,,	,,	100	183	19·65	35·50
14	,,	,,	200	366	19·68	35·56
15	,,	,,	300	549	19·61	35·43
16	,,	A3	0	0	19·65	35·50
17	,,	,,	100	183	19·65	35·50
18		,,	200	366	19·63	35·47
19	,,	,,	300	549	19·58	35·38
20	13	A4	0	0	19·61	35·43
21	,,	,,	50	91	19·63	35·47
22		,,	90	165	19·61	35·43
23		A5	0	0	19·61	35·43
24	,,	,,	50	91	19·61	35·43
25	,,	,,	80	146	19·60	35·41
26	,, 20	A7	0	0	19·67	35·54
27	,, 21	A6	0	0	19·61	35·43
28	,,	A7	100	183	19·65	35·50
29	,,	,,	150	274	19·61	35·43
30	,, 22	A8	0	0	19·65	35·50
31	,,	,,	100	183	19·65	35·50
32	,,	,,	150	274	19·65	35·50
33	,,	,,	250	457	19·60	35·41
34	,,	,,	350	640	19·61	35·43
35	,,	,,	450	823	19·67	35·54
36	,, 23	A9	0	0	19·67	35·54
37	,,	,,	100	183	19·65	35·50
38	,,	,,	250	457	19·58	35·38
39	,,	,,	350	640	19·72	35·63
40	,,	,,	440	805	19·75	35·68
41	Oct. 4	III.	35	64	19·65	35·50
42	,,	,,	70	128	19·59	35·40
43	,,	,,	0	0	19·67	35·54
44	,, 10	IV.	30	55	19·67	35·54
45	,,	,,	57	104	19·73	35·64
46	,, 16	V.	70	128	19·76	35·70
47	,,	,,	35	64	19·61	35·48
48	,, 19	VI.	30	55	19·60	35·41
49	,,	,,	57	104	19·89	35·03
50	,, 20	IV.	0	0	19·65	35·50
	1901					
51	Jan. 12	IV.	0	0	19·59	35·40
52	,,	,,	115	210	19·71	35·61
53	,, 19	V.	0	0	19·51	35·25
54	,,	,,	112	205	19·61	35·43
55	Feb. 2	III	0	0	19·63	35·47
56	,,	,,	130	238	19·59	35·40
57	,,	VI	0	0	19·60	35·41
58	,,	,,	153	280	19·65	35·50
59	May 11	A1	0	0	19·71	35·61
60	,,	,,	57	104	19·72	35·63
61	,,	,,	114	209	19·67	35·54
62	,,	,,	0	0	19·74	35·66
	1901					
63	May 15	A2	0	0	19·70	35·59
64	,,	,,	100	183	19·65	35·50
65	,,	,,	200	366	19·65	35·50
66	,,	,,	300	549	19·65	35·50
67	,,	,,	400	732	19·53	35·28
68	,,	,,	500	914	19·61	35·43
69	,,	60° 43′ N. 3° 22′ W.	0	0	19·69	35·58
70	,,	60° 35′ N. 2° 25′ W.	0	0	19·76	35·70
71	,, 21	A3	0	0	19·69	35·58
72	,,	,,	100	183	19·67	35·54
73	,,	,,	200	366	19·65	35·50
74	,,	,,	300	549	19·65	35·50
75	,,	,,	400	732	19·65	35·50
76	,,	A4	0	0	19·66	35·52
77	,,	,,	80	146	19·65	35·50
78	,,	,,	115	210	19·63	35·47
79	,,	A5	0	0	19·65	35·50
80	,,	,,	80	146	19·65	35·50
81	,, 29	A6	0	0	19·63	35·47
82	,,	,,	100	183	19·65	35·50
83	,,	,,	150	274	19·65	35·50
84	,,	A7	0	0	19·65	35·50
85	,,	,,	80	146	19·65	35·50
86	,,	,,	130	238	19·65	35·50
87	,,	61° 37′ N. 6° 18′ W.	0	0	19·70	35·59
88	,, 30	61° 30′ N. 6° 37′ W.	0	0	19·81	35·79
89	June 3	A8	0	0	19·69	35·58
90	,,	,,	100	183	19·69	35·58
91	,,	,,	200	366	19·66	35·52
92	,,	,,	255	467	19·65	35·50
93	,,	A9	0	0	19·67	35·54
94	,,	,,	100	183	19·63	35·47
95	,,	,,	200	366	19·65	35·50
96	,,	,,	300	549	19·61	35·43
97	,,	,,	400	732	19·65	35·50
98	,,	60° 56′ N. 5° 18′ W.	0	0	19·65	35·50
99	,, 4	A11	0	0	19·72	35·63
100	,,	,,	100	183	19·78	35·73
101	,,	,,	200	366	19·68	35·56
102	,,	60° 37′ N. 3° 30′ W.	0	0	19·71	35·61
103	,, 19	A1	0	0	19·68	35·56
104	,,	,,	50	91	19·71	35·61
105	,,	,,	100	183	19·71	35·61
106	July 4	,,	0	0	19·70	35·59
107	,,	,,	80	146	19·71	35·61
108	,,	,,	115	210	19·69	35·58
109	,, 5	A2	0	0	19·67	35·54
110	,,	,,	100	183	19·67	35·54
111	,,	,,	200	366	19·66	35·52
112	,,	,,	300	549	19·65	35·50
113	,,	,,	400	732	19·63	35·47
114	,,	,,	500	914	19·65	35·50
115	,, 6	A3½	0	0	19·65	35·50
116	,,	,,	100	183	19·63	35·47
117	,,	,,	220	403	19·66	35·52
118	,,	A4	0	0	19·67	35·54
119	,,	,,	80	146	19·65	35·50

No. of sample.	Date.	Position.	Depth. fath	Depth. m.	Cl.	Salinity per mille
	1901.					
120	July 6	A4	110	201	19·65	35·50
121	,, 7	A5	0	0	19·65	35·50
122	,, 14	A6	0	0	19·70	35·59
123	,,	,,	45	82	19·65	35·50
124	,,	,,	100	183	19·68	35·56
125	,,	A7	0	0	19·72	35·68
126	,,	,,	50	91	19·71	35·61
127	,,	,,	120	220	19·63	35·47
128	,, 15	A8	0	0	19·66	35·52
129	,,	,,	100	183	19·65	35·50
130	,,	,,	200	366	19·70	35·59
131	,,	,,	266	487	19·61	35·48
132	,, 16	A9	400	732	19·68	35·47
	1902.					
133	May 17	A1	0	0	19·74	35·66
134	,,	,,	50	91	19·72	35·62
135	,,	,,	100	183	19·65	35·50
136	,, 20	A3	0	0	19·69	35·57
137	,,	,,	100	183	19·61	35·48
138	,,	,,	200	366	19·48	35·10
139	,,	,,	300	549	19·50	35·28
140	,,	,,	400	732	19·48	35·19
141	,, 21	A4	0	0	19·63	35·46

No. of sample.	Date	Position.	Depth. fath.	Depth. m.	Cl.	Salinity per mille
	1902.					
142	July 21	A4	100	183	19·60	35·41
143	,, 30	A6	0	0	19·68	35·46
144	,,	,,	100	183	19·59	35·39
145	,, 31	B1	0	0	19·65	35·50
146	June 1	B2	0	0	19·72	35·62
147	,,	B3	0	0	19·79	35·75
148	,, 19	A1	0	0	19·62	35·44
149	,,	,,	100	183	19·59	35·39
150	,, 21	A2	0	0	19·60	35·41
151	,, 22	A3	0	0	19·60	35·41
152	,,	,,	100	183	19·57	35·35
153	,,	,,	200	366	19·59	35·39
154	,,	A4	0	0	19·61	35·43
155	,,	,,	100	183	19·60	35·41
156	,,	A5	0	0	19·68	35·46
157	,, 26	A6	0	0	19·60	35·41
158	,,	,,	100	183	19·59	35·39
159	,, 27	Between A7 and A8	0	0	19·60	35·41
160	,,	,,	155	284	19·59	35·39
161	,, 28	Between A2 and A9	200	366	19·18	35·19
162	,,	,,	400	732	19·42	35·08

THE VOLCANIC ERUPTION ON TORISHIMA.

Herr Max Kutschera, Austro-Hungarian consul at Yokohama, contributes a short article on the volcanic eruption on the island of Torishima to the *Mitteilungen* of the Vienna Geographical Society. As little information about this remarkable outburst has reached this country, we reproduce Herr Kutschera's paper in full.

The expedition despatched to Torishima by the steamer *Hiogo Maru* on August 22, has just returned. The official report of the two University professors sent as scientific experts has not yet been issued, but we have the accounts of newspaper correspondents who accompanied the party, and sketches of the island as it appeared before and after the eruption have been published in the Japanese paper *Tokyo Nichi-Nichi*.

Figures 1 and 3 represent the original form of Torishima. The highest mountain peak (1) was Komochi-yama, 359 metres in height, in the centre of the island, a long-extinct volcano with three small craters (14). On the flanks of Komochi-yama was Asahi-gama (335 metres), on the north-east (3), and Tsukiji-yama (265 metres) on the south-west (2). The mountains sloped steeply to the coast, which had only one large inlet, Chitosoma (4), on the north. Behind this inlet, on a terrace 27 metres above the sea, was the settlement Tamaki-mura (5), consisting of forty houses, and named after the farmer of the island, Mr. Han-imon Tamaki, in whose service the inhabitants hunted birds and collected and shipped feathers, birds' bones, and guano. To facilitate their work, a small tramway worked with a wire rope (6) had been laid halfway up the Komochi-yama. The actual hunting season on Torishima lasted from November to February, and during these months some 500 people resided on the island. The produce of the island last year amounted to—feathers, 9622 yen (1 yen = 2*s.*); birds' bones, 522.20 yen; guano, 3780 yen; and oil, 6630 yen. The settlers possessed 39 cattle and

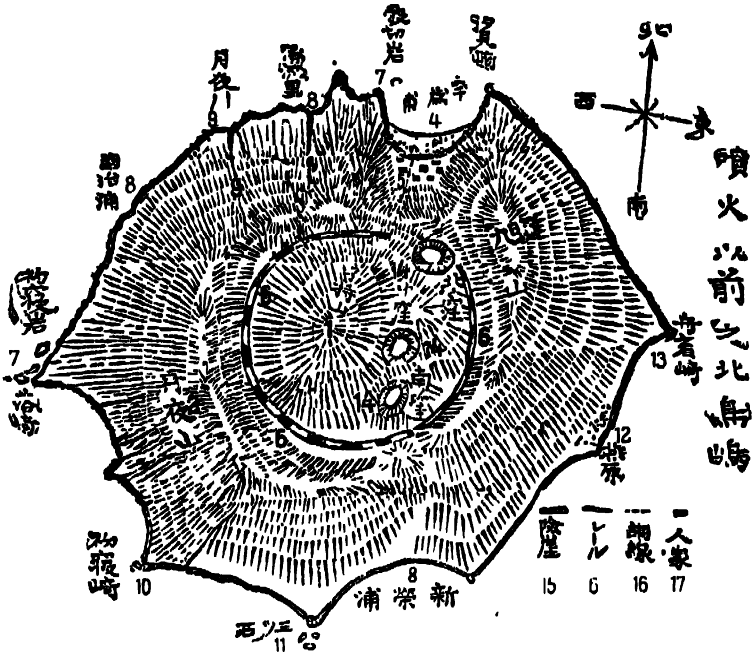


FIG. 1.—TORISHIMA BEFORE THE OUTBREAK.

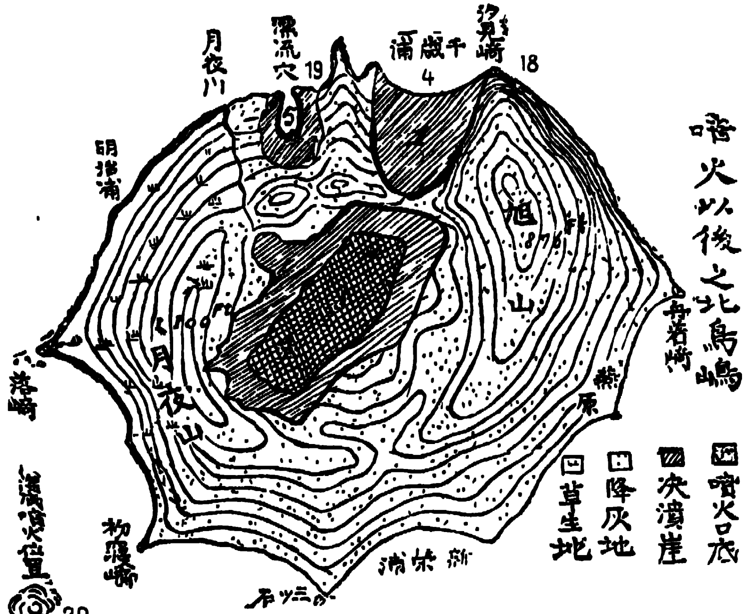


FIG 2.—TORISHIMA AFTER THE OUTBREAK.

46 pigs, and had cultivated gardens, growing potatoes and other vegetables. Most of the island was covered with grass and bush. Several islets (7 and 11) studded the coast, which was broken by smaller inlets, as (8). A small brook (9), flowing from Komochi-yama, entered the sea in the north-west. The coast between Cape Katsumi (10) and Cape Funatsuki (13) was flat and sandy in places, elsewhere the slope to the sea was steep, as at (15).

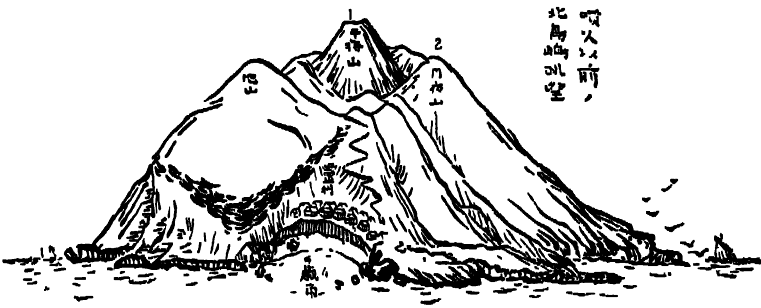


FIG. 3.—TORISHIMA, SEEN FROM THE NORTH BEFORE THE OUTBREAK.

After the eruption the island appeared as shown in Figs. 2 and 4. The peak of Komochi-yama has entirely disappeared, and its place is occupied by a crater 400 metres long and 200 metres wide, with almost perpendicular walls consisting of ash to a depth of 61 metres below the margin, and still emitting quantities of gas. With the exception of a small corner in the south-west, where the vegetable gardens are still flourishing, the whole island is covered with ash and strewn with

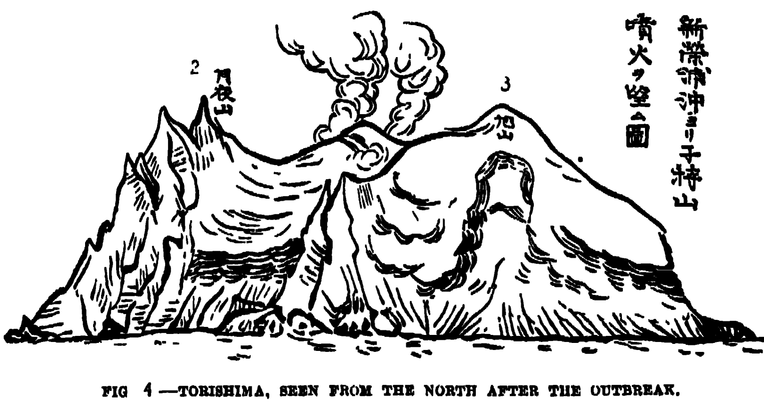


FIG 4.—TORISHIMA, SEEN FROM THE NORTH AFTER THE OUTBREAK.

lava-blocks. The terraced descent to the bay on which Tamaki-mura stood, has disappeared under ashes, and its place is taken by a steep slope, under which, as may be supposed, the village and all its inhabitants lie buried. The brook (9) is no longer to be found, and a new inlet (5), cut deep into the coast, has made its appearance.

On the south-west coast quantities of hot water issue from a submarine volcano,

or more probably a hot spring (Fig. 2, No. 20). The ash covering the slopes of the mountain is still very hot in places, but there is no other sign of continued volcanic activity.

It may be assumed that the catastrophe was due to the accumulation of gas within the Komochi-yama; the pressure ultimately forcing an outlet by blowing off the top of the mountain, and scattering the material of which it was composed all over the island. This assumption is supported by the facts that no fresh lava has come to the surface, that the outburst occurred quite suddenly, and that there is no indication of continued activity. The suddenness of the explosion may be judged from the fact that not one of the 125 inhabitants saved his life, although several boats were handy. These boats were kept hauled up on the beach because of the heavy surf, and apparently there was no time to get them off. Since no human bodies have been found, only the half-burnt remains of two cows, it may be surmised that the outburst took place during the night (August 9 and 10), while all the inhabitants were in bed. From the present configuration of the position occupied by the village, it would seem that the huge mass blown up by the explosion fell upon it like a blow, and that the annihilation was complete. The absence of ashes on the south-west of the island is no doubt due to the prevailing westerly wind.

THE BRITISH ANTARCTIC EXPEDITION: RETURN OF THE "MORNING."

THE eagerly expected news of the British Antarctic Expedition was received on March 25, when the arrival of the *Morning*, the relief ship of the expedition, at Lyttelton, N.Z., was reported through Reuter's agency, Commander Scott's brief summary of the work so far accomplished being received on the same day. The report shows that, while coming in for their full share of difficulties and hardships, the gallant explorers have already accomplished an amount of excellent work which justifies us in considering the general results of the expedition as thoroughly satisfactory. One of the officers, Lieut. Shackleton, is, we regret to say, coming home invalided, having suffered much from exposure during an arduous sledge expedition; while one of the seamen was unfortunately drowned by falling from a cliff during a blizzard. Otherwise the health of the party appears to have been good, in spite of some privation experienced before the arrival of the *Morning* through the deterioration of some of the supplies. The *Discovery* has revictualled from the *Morning*, and is remaining in the Antarctic for another winter; we may thus hope that considerable additions will be made to the results already gained.

The telegraphic summary naturally leaves some points obscure, and we must depend to some extent on conjecture in piecing together a connected account of the doings of the explorers. This is especially the case from the fact that the field of the explorations is traversed by

the 180th meridian, and a distinction is not always made between the longitudes on the two sides of this line. The pack was entered early in January, 1902, in lat. 67°. After visiting Cape Adare, Wood bay, and an excellent harbour in lat. 76° 30′, a record of the voyage was left at Cape Crozier on January 22. The *Discovery* then followed the ice-barrier eastward, and in 165° it was found to trend northward, the water becoming shallow. From the edge of the barrier high snow-slopes rose to an extensive, heavily glaciated land, with occasional bare and precipitous peaks. The coast-line was followed to lat. 76°, long. 152° 30′, or quite 150 miles beyond the furthest previously reached in this direction.

Returning, the ship put into an inlet in the barrier in long. 174°, and a sledge-party examined the land as far as 78° 50′ S. Excellent winter quarters having been found on an island near Mounts Erebus and Terror, the coast of Victoria Land was examined as far as a conspicuous cape in 78° 50′ S., where, contrary to previous statements, mountains do not exist. The ship was frozen in on March 24, and, in spite of boisterous weather, the expedition passed a comfortable winter in well-sheltered quarters. The lowest temperature recorded was 62° below zero. Sledging commenced on September 2, and a record was established by a party under Lieut. Royds and Mr. Skelton during a trying expedition to Mount Terror; while Commander Scott, Dr. Wilson, and Lieut. Shackleton travelled 94 miles to the southward, reaching land in lat. 80° 17′ S., long. 163° W.,* thus attaining the farthest south ever reached by man. The journey was accomplished in most trying conditions. The dogs all died, and the three men had to drag the sledges back to the ship, this being the occasion on which Lieut. Shackleton nearly lost his life through exposure. Victoria Land was found to be traversed by ranges of high mountains, which in 82° reach a height of 10,000 to 12,000 feet. Foothills resembling the Admiralty range were found in 160°, and a party ascending a glacier reached an unbroken level plain at an altitude of 9000 feet. The coast-line was seen to continue nearly due south to at least 83° 20′ S. Commander Scott considers that the ice-barrier, which continues horizontal, is afloat, though slowly fed from the land-ice.

The chief point left obscure in the above account is the continuity or otherwise of the easternmost land seen, which was traversed by a

* It is probably safe to conclude that the direction of this longitude is west from the 180th meridian, to which initial line the explorers, like their predecessors in this region, would be naturally inclined to refer their movements, though the amount of the longitude is, of course, reckoned from Greenwich. In all previous cases the longitude has been given without statement of direction, and the positions appear to lie east of 180°, or in longitude *west* from Greenwich. In mentioning the direction here, Commander Scott would seem to emphasize the fact that the longitude is on the opposite side of 180° to those previously given.

sledge-party to 78° 50′ S., with Victoria Land. Probably the data obtained did not permit of an answer being given to the question, but in any case a deep gulf appears to run south, in the intermediate area, to beyond 83°. In addition to the purely geographical results, the work of the expedition has included important observations in the field of marine biology, magnetism, oceanography, meteorology, seismology, etc. Geological data were also obtained, and a number of excellent photographs taken.

Since the above was written it has been ascertained that Captain Scott, on his sledge expedition, reached 82° 17′ S. instead of 80° 17′.

ADDITIONAL REMARKS ON NEW DISCOVERIES IN THE TEXT OF CARPINI.

The question of the original manuscript authority for the 'Historia Mongalorum' of John de Plano Carpini has been still further complicated by the extraordinary oversight which has made two manuscripts out of one, at the same time that one of the two most important, oldest, and best copies was passed by altogether. For while on one hand the Corpus manuscript (No. 181) was never collated or examined, on the other hand the copy once in Lord Lumley's possession and known as the Lumley manuscript, from which Hakluyt copied (with mistakes enough) his text in the 'Principal Navigations,' appears to be no other than the identical copy now in the British Museum (Reg. 13 A xiv.) known as the London manuscript. The 'two' differ in this only: 'Lumley' is the text with Hakluyt's mis-readings; 'London' is the same text, the same copy, as more accurately read by nineteenth-century scholars. Owing to the oversight of Thomas Wright, when he collated, or professed to collate, the English manuscripts of Carpini for d'Avezac's edition of 1838 (reprinted, 1839, in the *Recueil*; this last being the form usually quoted), readings from 'Lumley' and 'London' appear together, in agreement or in opposition, upon nearly all the pages of the standard edition of the great traveller (see the *Recueil de voyages et de mémoires publié par la Société de Géographie*, vol. iv., 1839). The London manuscript is known to have come into the possession of the British Museum with the other Lumley manuscripts. In evidence of its origin, the flyleaf, folio 1, recto, bears the names of 'Arundel' and 'Lumley' written in a stiff hand at the foot of the page.

As to the 'new' or at least hitherto unexamined manuscript of Carpini in the manuscript vol. No. 181 of the Corpus Christi College collection in Cambridge, a manuscript which we may best call 'Corpus,' and which (as already pointed out) is the same as the manuscript called by old catalogues 'Bennet College No. 61,' a further examination enables me to add some remarks to those I have already made in the *Geographical Journal* for December, 1902. There are, in all, thirty-two passages, longer or shorter, which may be called author's additions, found only in the Corpus (or Cambridge) and the Petau (or Leyden) manuscripts. In all of these the similarity of the two is close: the differences are rarely more than verbal. It is, perhaps, in the chapter headings that most variations are to be found, and even here the variations are not numerous or considerable. Carpini's four great name-lists—of the Mongol princes, of the nations subdued by the Mongols, of the

nations that had successfully resisted them, and of the witnesses to the veracity of his narrative—the last a catalogue which includes all the Italian merchants whom Friar John could remember as trading at Kiev on his return in 1247—are identical in the Cambridge and Leyden manuscripts, whose relationship is unquestionably that of sister texts.

C. RAYMOND BEAZLEY.

REVIEWS.

ASIA.

CHINA AND JAPAN.

'On the Coasts of Cathay and Cipango Forty Years ago.' By William Blakeney, R.N. London: Elliot Stock. 1902.

The author gives some interesting reminiscences of survey work on the coasts of China and Japan in which he took part during the years 1856–62. In the course of the operations in the far East during the Crimean war, the ignorance which then prevailed on the hydrography of those regions (the island of Sakhalin was still supposed to be connected with the mainland) had much hampered the movements of the British fleet, and it was therefore resolved, on the conclusion of peace, to despatch a surveying ship for the proper charting of the coasts. The choice fell on the sailing frigate *Actæon*, which was placed under the command of Captain W. Thornton Bate (killed in 1857 at the taking of the Canton forts), Mr. Blakeney serving as one of the survey officers. During the commission of the *Actæon* important surveys were carried out in many parts of the eastern seas, of which accurate charts were thus for the first time made available. The interest in the book lies chiefly in the means of comparison it affords between those days and our own, both as regards the countries and politics of the Far East and the life on board the ships of the British navy. Many of the events are, of course, well-known history, but the personal element in the narrative gives it some freshness. Mr. Blakeney considers that modern events in the East threw their shadows before them, even at that distance of time, and he shows that the recent Russian advance really had its first beginning in those days. Among the coasts and ports surveyed by the *Actæon*, one of the most important was the sound on the west coast of Tsusima, on the strategical importance of which the writer again and again insists, and which the Russians made an abortive attempt to occupy in 1860. It was a fact frustrated largely through the arrival of the *Actæon*. The book is illustrated by some spirited sketches by Mr. Blakeney's brother officer, Mr. Bedwell, as well as by copies of Chinese and Japanese pictures, charts of the coasts, and various early drawings and photographs.

AFRICA.

EAST AFRICA.

'Two African Trips, with Notes and Suggestions on Big Game Preservation in Africa.' By Edward North Buxton. London: Stanford. 1902.

In this volume Mr. Buxton puts before the public his field-notes taken during two holiday trips, made chiefly for purposes of sport, the one in British East Africa, the other on the White Nile. Of geography pure and simple it naturally contains little with any title to novelty, but the book has special claims to

notice from another point of view. The author is not a mere slayer of big game, but an enthusiastic student of the habits and life-conditions of living beasts and birds. He has, for the first time, made a serious attempt to photograph African wild life amid its natural surroundings, and the very successful results (when we think of the difficulties which such an attempt must involve) are given in the present volume in a most interesting series of pictures. The absorbing interest of the "camera-stalks" necessary to secure these results can well be imagined, and Mr. Buxton insists with justice that a successful picture of wild life is a higher achievement, even in the realm of mere sport, than a trophy, however imposing. Now that he has led the way, we may expect that other travellers will follow suit, and a new interest will thus attach to many of the future narratives of African travel. Mr. Buxton is deeply interested in the question of the preservation of the larger species of African wild animals, and both his remarks on the subject, and his map on which all the game reserves of the British protectorates in East Africa are laid down, are of value in this connection. He clearly shows that the mere marking off of such-and-such areas as reserves is not enough, but that careful attention must be given to the surrounding conditions, the needs of the game, and especially their periodical migrations. Besides the photographs of living birds and beasts, there are others which illustrate native life, types of scenery and vegetation, etc., some of the river-bits in British East Africa being particularly striking.

AMERICA.

Colonial History.

'New France and New England.' By John Fiske. London: Macmillan. 1902.

This volume was intended by its author, the late Mr. Fiske, to complete the series of historical works already published by him on the history of the North American colonies. The early history of the United States had been dealt with in the two volumes, 'The Beginnings of New England,' and 'The Dutch and Quaker Colonies in America,' while the more recent part of the story had been told in his 'American Revolution.' The intervening period was marked above all by the increasing rivalry between France and England in North America, and its final arbitrament by the victory of Wolfe. In the present volume, therefore, the author traces the growth of New France from the time of Cartier and Champlain to La Salle, and then describes the development and gradual extension westwards of the British colonies, which led to constantly increasing friction between the two nations. Much of the story has, of course, been often told before, in the writings of Winsor, Parkman, and others, but many readers will no doubt appreciate the opportunity of learning the salient facts of the struggle within the convenient compass of Mr. Fiske's narrative. The fifth and sixth chapters seem, perhaps, hardly to fall into line with the rest, as they treat solely of the internal condition of the British colonies, mainly from the point of view of religion. There are several reproductions of early maps, while references to other authorities will help those who wish to pursue the subject further.

South America.

'Down the Orinoco in a Canoe.' By S. Pérez Triana. London: Heinemann. 1902.

This gives a somewhat slight and popular account of a journey from Bogotá to the Orinoco and down the course of that river to its mouth. The author, son of an ex-President of Colombia, was, during one of the periodical South American revolutions, forced to seek safety in flight, and the only way open for this was that across the vast forests which stretch eastward from the foot of the Andes. The

journey appears to have been made some years ago, though dates are eschewed throughout. This, however, is of the less importance that the region traversed is one of the least-known recesses of the continent, and its picture can vary little in the course of a few years. It is, in fact, this very remoteness from the world, of these interior fastnesses described in its pages, which gives to the book an interest it would not otherwise possess. The author waxes eloquent in his descriptions of the vast forests and mighty rivers which lay on his route, though to English ears his language may sound somewhat flowery; while the printing of a laudatory preface by another hand—an objectionable practice which has become too common of late—is by no means a recommendation.

OCEANOGRAPHY.

Atlas of the Atlantic Ocean.

'Deutsche Seewarte: Atlantischer Ozean. Ein Atlas von 39 Karten, die physikalischen Verhältnisse und die Verkehrsstrassen darstellend. Mit einer erläuternden Einleitung und als Beilage zum Segelhandbuch für den Atlantischen Ozean.' 2 Auflage. Herausgegeben von der Direktion. L. Friederichsen & Co., Hamburg. 1902.

When the second edition of the 'Segelhandbuch für den Atlantischen Ozean' was published in 1898, it was stated that the publication of the Atlas belonging to it would be delayed until it was possible to incorporate in the maps the results of a number of investigations then in progress, especially those of the great "Zehn Grad-Quadratarbeit," and of the *Valdivia* expedition. The work has now been completed, and the atlas was issued at the end of last year. The maps, which are drawn on Mercator's projection, have been reproduced by Wagner and Debes, and are without exception excellent specimens of cartography. The chart of depths (No. 1) shows very strikingly how greatly recent soundings have modified our conception of the relief of the bed of the Atlantic; it is practically a reduction of the admirable equal-area map compiled by Dr. G. Schott for the report on the *Valdivia* expedition. Sheet 2 shows the temperature of water at 400 metres below the surface.

In sheet 3 the surface currents and distribution of drifting ice and weed are shown for mid-winter of the northern hemisphere. This map, which has been drawn up by Prof. Krümmel, is particularly important, as it represents generalizations from observed facts rather than, as in the case of most of the others, simply the facts themselves. The problem of drawing a satisfactory current chart still remains, it seems to us, to be satisfactorily solved. Nearly all are much too suggestive of "rivers in the oceans," and in some respects we prefer the wavy arrows of the Meteorological Office Current Charts to the stream-lines of this atlas. The marking of regions where "drift" currents predominate by a special colour is an excellent feature, although we should have expected to find part of the equatorial belt so marked, as well as the extra-tropical west-wind areas. While it is true in a certain sense, as Prof. Krümmel says, that the general current system in the Atlantic undergoes little seasonal variation, we can hardly agree that the winter chart serves quite satisfactorily for the whole year. The drift circulation shown on the map for the North Atlantic closely represents the average state of affairs in winter, but in summer the general movement in the belt, say, between lat. 50° N. and lat. 60° N., is more from the west, while on the eastern side the northerly movement is frequently absent, and sometimes, at least, is altogether reversed between Iceland and the British Isles.

The four following maps, Nos. 5 to 8, show the distribution of surface temperature for the months February, May, August, and November. Sheet 9 gives the mean annual temperature of the air, and sheet 10 the temperature for the four months, over the whole Atlantic basin. These last are particularly valuable, as they extend from long. 100° W. to 30° E., and include all South America, and parts of Europe, North America, and Africa. The next two sheets give the air-temperatures for each month over the oceanic area alone; all these maps are new, and depend largely on the "Zehn Grad-Quadratrabeit." Sheets 13 to 16 deal similarly with atmospheric pressure, the material being derived from the same sources. Next follows a series of charts illustrating the general meteorology of the Atlantic, the most complete and exhaustive series of its kind in existence, and one which will well repay the study of every teacher of geography, as well as of every student of special climatology. It is unnecessary to give the full list of the maps, and it is difficult to single out any as of special value, but without prejudice to the others we may mention the plate showing weather types, from Köppen and van Bebber's well-known papers; the maps of duration and direction and mean change of wind-direction of storms, from the important paper published by E. Knipping in the *Annalen der Hydrographie* for August, 1901; the chart of mean frequency and tracks of cyclones in the North Atlantic; and the rainfall charts.

The last section of the atlas includes three maps showing the magnetic elements for 1902, two showing the chief routes for steamers and sailing vessels during the winter and summer months, and one by Dr. H. Bolan showing the distribution of the chief species of whales, with the fishing-grounds.

H. N. D.

GENERAL.

The Geographer at High Altitudes.

'Climbing on the Himalaya and Other Mountain Ranges.' By J. Norman Collie, F.R.S. Edinburgh: David Douglas. 1902.

In this volume Professor Collie has given us something of his mountaineering experiences in many lands. Portions of the book are not entirely new, having appeared in other guise, to wit in the pages of the *Alpine Journal* and in the publications of the Scottish Mountaineering Club.

Although nominally addressed to the mountaineer, the work is full of interest to the geographer, and is illustrated by some fine photogravures from the author's negatives. The most important portion of the book is undoubtedly that dealing with the Himalaya, which occupies the first half of the volume. After an introductory chapter on the history of mountaineering in India, the author carries us away to his own special district between the Astor river and the Indus, where the Diamirai, Rupal, and several minor glaciers cluster on either flank of the lofty Nanga Parbat range. In this introductory chapter we have an interesting epitome of the chief ascents and expeditions in various parts of the range. In this connection it is interesting to note that the author accepts Mr. Graham's account of his ascent of Kabru (24,015 feet) in the Kangchenjunga range, summing up the evidence in the following sentence: "Any one who will take the trouble to read his account of the ascent of Kabru, cannot fail to admit that he must have climbed the peak lying on the south-west of Kangchenjunga, viz. Kabru, for there is no other high peak there which he could have ascended from his starting-point except Kangchenjunga itself. . . . Now, if they climbed Kabru, they were at a height of 24,000 feet whether they had a barometer with them or not, for that is the height determined by the Ordnance Survey." In this conclusion he agrees

with Mr. Freshfield, who visited the peak in 1899, and Kabru must in future be placed first in the catalogue of mountain ascents as the highest point on the Earth's surface yet attained by man. One of the chief arguments urged against this ascent was the assertion that Graham makes practically no reference to the pangs of mountain sickness, which it is assumed he must have felt acutely at this altitude. Our author's experience in this respect agrees with that of Sir M. Conway, Mr. Freshfield, and others who have visited the Himalayas of recent years. Only once did the party on Nanga Parbat experience any real ill effects from this cause, and that was, as in similar cases, at a height below 18,000 feet.

This expedition to Nanga Parbat, undertaken in 1895 with Mr. G. Hastings and the late Mr. A. F. Mummery, is a record of a very plucky attack, without the assistance of professional guides, on a difficult and isolated range. Between July 17 and August 24, the party ascended the Diamirai peak (19,000 feet) and crossed the Diamirai pass (18,000 feet) and other minor passes in the range, while a height of 20,000 feet was reached by Mummery and Ragobir on Nanga Parbat, and 21,000 on the rocks above the Mazeno pass by Mummery and Hastings. Altogether the climbing appears to have been of the severest kind, and the ascent of Nanga Parbat does not seem to be any nearer immediate realization than that of Kangchenjunga or K_2. The sad accident which brought this expedition to a sudden conclusion is now well known. In attempting to cross the Diama pass, Mummery, Ragobir, and Gorman Singh disappeared for ever, having most likely, it seems, been overwhelmed by an avalanche falling from the north face of Nanga Parbat. Thus perished the most brilliant amateur climber of his day, and one who had but few equals among professional mountaineers.

The chapter which follows on the Canadian Rocky mountains forms a charming introduction to the mountain geography of this little-known region. The nomenclature of peak and glacier on the accompanying map shows that here, as elsewhere, the English mountaineer is still to the fore, such names as Freshfield, Bryce, Dent, Stutfield, and Mummery speaking for the nationality of the explorer in no uncertain voice, while the fact that, with one sad exception, they are names of living and active mountaineers testifies to the recent date of their discovery. We have only one fault to find with this chapter, and that is that it is all too short. We feel that the reader has been mentally jilted; he has been led on to admire this fair country, the description of which has been clothed in most attractive garb, only to find himself excluded in the end from more intimate confidences. He would like to have heard more of that interesting group the Colombia range, discovered by the author and his party in 1898, of the characters of the group, and the nature of the climbing they afford. But perhaps, if rumour is to be trusted, the author, like a skilful cook, has merely whetted the appetite of his readers by an *hors-d'œuvre*, to be followed by a joint work dealing exclusively with this fascinating country.

In the chapter on the Lofoten islands, the author shows himself a master of terse analysis; thus, in speaking of the characteristic scenery produced by ice-erosion, he very happily describes the country as having been "worn to the bone"—that is, suffered the removal of its softer superficial covering: a truer description of ice-work than the author perhaps intends, for, in speaking of the Ofaten fjord, he mentions "valleys whose sides for miles are perpendicular walls of rock, sometimes a couple of thousand feet high, and which have undoubtedly been excavated and then polished by the power of ice." With due deference to the distinguished author, we would like to query the "undoubtedly," especially as we read in the same paragraph, "On Nanga Parbat I have seen a vast glacier turned to one side by its own moraine;" and we would like to recall the fact that the same phenomenon has

been frequently described recently from "an arctic ice-sheet such as that on Greenland" or Spitsbergen.

The remaining chapters are, perhaps, less geographical in their aim. The chapter on the Alps (giving incidentally an account of one of the author's most brilliant ascents with Mummery up the Brevna route of Mont Blanc) should be read by all who affect to despise this cradle of the mountaineering race. It contains some of the best-written pages in the book. In spite of modern innovation, the Alps will retain their splendid fascination for many a year to come. "The overhanging cornices high above, for ever on the point of breaking off, will still hang poised in unstable equilibrium. The storms will sweep as frequently as of old across that mountain land, holding for a brief space all in gloom; the lightning-flashes, the roar of the thunder, the driving snow, and the keen biting wind will hunt the too presumptuous climber back to lower altitudes, as they have done often before; and afterwards the sun will shine again, dissolving the clouds, drying the lower slopes, and showing how the old mountains have once more put on a clean garment, which, in magnificence, in glittering splendour, is as unmatched or unequalled as the deep glowing colour of that 'solitary handmaid of eternity,' the open ocean, or the glories of the heavens at dawn or at sunset."

The author's passion for sunsets is very marked, and gives rise to some of the finest passages in the book, and his feeling for scenery is evinced in every page. What could be more graphic than the following description of the Lofoten islands?—"For those who care to climb where great expanses of sky and clouds arch slowly down to the far-off horizon, and where lonely islands are set in open spaces of blue water, those remote Lofoten mountain fastnesses beyond the arctic circle are difficult to equal. The low circling sun making it for ever afternoon, flooding sky and mountain land in warm luminous colour, which deepens the distances, and adds perspective to ridge after ridge of serrated and barren peaks."

Though the description of actual mountain ascent is limited to a few portions of the book, every page breathes out the spirit of the everlasting hills, the attar of mountain memories distilled from the soul of one of Nature's truest worshippers. It is indeed a charming book.

E. J. G.

THE MONTHLY RECORD.

THE SOCIETY.

The Awards for 1903.—The Royal Medals and other premiums of the Society have been awarded this year as follows: The Founder's Medal has been assigned to Mr. Douglas W. Freshfield, in recognition of his valuable contributions to our knowledge of the Caucasus, both by his journeys and writings, and for his recent explorations round Mount Kangchenjunga. It is also intended as a mark of appreciation of his persistent efforts in behalf of the improvement of geographical education. The Patron's Medal will be given to Captain Otto Sverdrup, for his important discoveries in the Jones sound region during his recent arctic expedition, as well as for the important part which he played as captain of the *Fram* during Dr. Nansen's famous expedition. The award of the Special Victoria Medal, given for geographical

research, to Dr. Sven Hedin, has already been announced in the *Journal*, as it was made during the recent visit of the explorer to this country. The Murchison Grant has been awarded to Mr. Isaachsen, Captain Sverdrup's right-hand man during his recent expedition, to whom many of the geographical discoveries made by the expedition were due. The Back Grant goes to Dr. W. G. Smith, for his investigations into the geographical distribution of vegetation in Great Britain; the Gill Memorial to Mr. Ellsworth Huntington, for his remarkable journey through the great cañon of the Euphrates, described in the *Journal* for August last; and the Cuthbert Peek grant to Major J. A. Burdon, for his excellent route-surveys in Northern Nigeria.

EUROPE.

A German Critic of the Ordnance Survey Maps.—In explaining, in a recent number of *Petermanns Mitteilungen* (1902, No. 10), the method adopted in the preparation of the new map of the British Isles for Stieler's Handatlas, Herr Koffmahn indulges in some criticisms of the English Ordnance maps, which are for the most part quite unfounded. His statements are, indeed, in many cases, so wide of the facts as to be quite inexplicable, except on the supposition that he has consulted some out-of-date sheets of the old edition; but as he shows himself in many respects conversant with the latest developments in the work of the Survey Office, it seems that this explanation cannot hold good. The criticisms are in many cases general ones, no specific instances of the alleged defects being quoted, so that it is impossible to reply to them except by an equally general negative, but there are also some definite statements, the incorrectness of which will be evident to all who are acquainted with the Ordnance maps. Thus, with reference to the 1-inch map, we are told that many sheets of the so-called "revised" maps date back thirty to forty years, the revision having taken place a generation ago. As a matter of fact, as may be seen from the date printed at the foot of each map, the oldest sheet was revised considerably less than ten years ago, while most of the sheets have been revised much more recently. Changes in county boundaries, in regard to which a complaint of inaccuracy is made, are inserted at each revision, while new railways are inserted from time to time as they are opened for traffic. To the statement that considerable towns of recent growth are still shown as villages, and that some populous industrial centres are represented as mere farms, it is obviously impossible to reply in the absence of any citation of instances. Herr Koffmahn appears to derive his ideas in many cases from criticisms which have been made in this country, failing to see that, even if true when first put forward ten to sixteen years ago, the subsequent revision has rendered them quite inapplicable at the present day. It is somewhat singular, also, that among the sources by which, as he says, he was obliged to supplement the maps of the Ordnance Survey, he should give a prominent place to Bartholomew's 2-mile map of Scotland, though this is itself avowedly based on the Ordnance maps. The criticisms on the inferior methods of hill-representation in vogue in this country are probably not intended to apply to the Ordnance maps—if so, it would be a sufficient answer to point to the 1-inch hill maps of the mountainous districts of Scotland, etc.—but rather to maps for use in schools. But, while allowing that these have been far from satisfactory in the past, and may still leave room for improvement, we hardly think that Herr Koffmahn is acquainted with the better class of school maps which have come into use within recent years. He expresses the hope that his own map of the

British isles may be largely used in this country as well as in Germany, and it cannot be denied that it gives an admirable general view of the surface features of the country—probably the best in existence, considering the size of the map. It is to be regretted, however, that the scale (1 : 1,500,000) is far too small to do adequate justice to the more thickly populated districts.

Afforestation in the Black Country.—A society for promoting the afforestation of the Black Country was recently inaugurated by a meeting held at Birmingham, at which Sir Oliver Lodge presided. It is a common idea that the large area in this district covered with ash-heaps and other *débris* is necessarily condemned to remain in a state of hideous barrenness, but it is satisfactory to find that such is not by any means the case. Commenting on the recent meeting, Prof. Schlich mentions, in *Nature* for February 26 last, an instance from the Belgian Ardennes, in which old slag and ash-heaps were found by him well stocked with oak and ash trees, some of them of considerable size, and he states that it was the knowledge of this fact which suggested to Mr. W. R. Fisher, to whom the credit of bringing it forward belongs, the idea that the Black Country might be utilized in the same way. The area with which it is proposed to deal is said to be some 14,000 acres, now covered by some extent by grass, and grazed over by sheep ; but if systematically planted, the advantage both from a utilitarian and æsthetic point of view could not fail to be important. In these days, when practical considerations alone are so apt to carry the day, it is pleasant to find that the less tangible results of such afforestation in the direction of improving the moral and æsthetic conditions of life in the Black Country met with due appreciation at the meeting. Prof. Schlich urges that the whole undertaking should be placed under the control of a single body representing the various interests involved, and suggests fast-growing conifers as the most suitable trees for planting.

The Diois and the Baronnies.—This region, which is described by M. Paquier in *La Géographie*, October to December, 1902, occupies the eastern part of the department of the Drôme between the plateau of Vercors in the north, Mount Ventoux and the ridge of the Lure in the south, Devoluy and Gap on the east, and the forest of Saou and Nyons on the west. The dividing-line between the Diois in the north and the Baronnies in the south is between Mount Angèle and Serres. Throughout the region synclinal elliptical valleys are characteristic. In the south they lie east and west, with a sharp deflection to the north on the extreme western end, whereas in the Diois the whole western region, with the exception of the forest of Saou, has the synclines stretching from north to south. The east-and-west direction is the older, and represents the pre-oligocene foldings which characterize the Pyrenees and Provence. The north-and-south synclines are due to post-Miocene foldings of the Alps, which are alone met with in the Vercors and the Chartreuse farther to the north. The region is therefore an intermediate one, becoming more and more provençal from north to south. The alternation mainly of harder and softer limestone determines scarped landscapes where they are not too steeply tilted, and series of saw-toothed ridges where the dip is nearly vertical in the anticlinal areas. The establishment of a stable drainage system in such a region of synclinal hollows sharply defined and surrounded by anticlinal ridges, can only be brought about when the anticlines are sufficiently worn down to become the seat of the principal streams. In the Baronnies a mature hydrographical system exists, but the successive stages of its evolution are often impossible to trace, while in the Diois, where recent tectonic movements have had greater play, especially on the western side, the mature condition has not been reached, and capture phenomena are easily recognized and testify to its less evolved condition. The western Baronnies are drained by the

Eygues and the Ouvèze to the Rhone. They rise in large downfolds, in which they flow from east to west; but in the west they turn to the south-west at right angles to the tectonic features of alpine trend across the transverse depression where the fold axis changes its direction. The eastern Baronnies were also originally drained to the west, but the wearing down of the upfold (in which glaciation played a part) along which the Buech now flows, has transformed the synclinal Méouge and Orpierre into obsequent rivers, while the westward flowing Lauzence, a tributary of the Méouge, is a relict of the old consequent system. In the Rosans valley this development is not so complete, for the greater part is still drained westwards by the Egyucs. The hydrography of the Diois is less mature. Eliminating the small part tributary to the Bueche and the south-east of the Valdrôme, the Diois is surrounded by upfolds with only two openings to the exterior of the Alps, the one used by the Oule, which drains the south, and that of the Drôme in the north. The course of the Drôme from south-east to north-west is determined by the folds, which are compounded of the east-west and north-south trends; from Die to Espinal it curves round the anticlinal margin of the north of the Diois plateau, but after passing the gorge at Verchery, it runs almost due west to the Rhone, parallel to the axis of the forest of Saou, but cutting across a transversal depression in the north-south folds which it crosses on the way as far as Crest. Its course here may be compared with that of the Eygues above Nyons. The valley of the Charce presents an admirable example of an asymmetric synclinal area, and in it the subsequent streams are of great importance. The Oule, which drains this valley, begins as a consequent torrent, but the synclinal axis is not followed by it, and the chief exit from the valley is by a subsequent channel at right angles to the synclinal axis. In the upper Jurassic limestone the irregularities of the gorges cannot be explained by external denudation, and it is necessary to take into account subterranean erosion.

Prof. Cvijić's Investigations in the Balkans.—With the object of completing his researches in the eastern and central parts, Prof. Cvijić has made explorations in the mountain region of the Balkan peninsula. During the last seven or eight years he has crossed it at forty different points, distributed over its entire length from the Zajecar basin in Servia to the Black sea; but the greater number of these crossings were made in the summer of 1902, and further excursions have been made to the Karadži mountains and the Istrandžadagh. As a result of these journeys considerable additions have been made to the geological maps, numerous sections have been drawn, and lines of folding determined. The relation of the Jaila mountains to the Balkans has been elucidated by an expedition to the Crimea, which permitted a study of the tectonic conditions of the coast ranges in that peninsula. Prof. Cvijić is now working up the large amount of material he has collected, and attaches special importance to the preparation of tectonic maps of the region where the Transylvanian Alps (between Hungary and Rumania) merge with the western Balkans, of the district to the south of the Iron Gates, and of the central and eastern parts of the long Balkan chain. The sections are also being elaborated on a large scale. We are informed that the observations in a number of places have been found to be still inadequate, and that Prof. Cvijić intends to remedy the deficiencies by further explorations next summer. The chief results of the investigation will be communicated to the International Geological Congress to be held at Vienna at the end of August, and the memoirs will be published by the Vienna Academy of Sciences.

The Middle Urals.—The second part of vol. xxxiv. of 'Mémoires de la Société de Physique et d'Histoire Naturelle de Genève' embodies the results of work by Prof. Louis Duparc and Dr. Francis Pearce in the district of Rastesskaya

and Kizilovskaya-Datcha, in the government of Perm. The region is watered by the upper Kosva and its feeders. This river is one of the numerous tributaries that flow westward to the Kama from the low hills of the Middle Ural, and joins the main river some hundred miles above Perm. The structure of this portion of the Ural system is of a highly complicated nature; its main lines run along parallel chains running north-east and south-west in the northern portion, but the general trend swings to south-east in the southern. The elevation is of course not great, the highest point reaching little over 4000 feet. The vegetation consists of dense coniferous and deciduous forests, while the valleys are exceedingly fertile. This section of the Ural system also includes the wealthy mineral workings which have their main market at Ekaterinburg. The particular section of the country worked by Prof. Duparc and Dr. Pearce is here described in very full detail. The orographical and hydrographical features are first considered, accompanied by a sketch of general conditions—flora, fauna, population, and the rest. We observe from the admirable illustrations which accompany this section how little the Ural system approximates to the appearance of a mountain range proper, which is usually accorded to it in maps. It appears in these photographs as a succession of low upheavals exactly of billow form—long slow swells succeeding one another in a regular alignment. The rivers are not particularly rapid, but are shallow, and offer no great facilities for regular communication, which, in effect, is difficult by any means. The travellers note how the long "pirogues," though of the lightest draught, frequently ran upon shoals. The second and third parts of the treatise are concerned, in the closest detail, with the geology of the two hills to which the travellers confined their most careful attention. The Urals present a considerable geological uniformity; the main axis, always on the eastern side of the upheavals, consists of a strip mainly composed of granites, porphyries, and rocks of a kindred nature, while the long western descent, with which we are concerned, has coverings from Silurian to Triassic. Thus a detailed examination of certain points is of value, and the careful analysis to which Prof. Duparc and Dr. Pearce have subjected the peaks of Koswinsky mountain, and the lesser height of Katéchersky, will prove of the greatest interest to close students of geology.

ASIA.

Tidal Periodicity of Earthquakes in Assam.—The idea that the relative frequency of earthquakes may be influenced in some way by the action of the Sun, Moon, or planets on the Earth has long met with attention on the part of scientific men, as a result of which certain generalizations have been put forward, as, *e.g.*, that earthquakes are more frequent in winter than in summer, and by night than by day. The laborious researches of M. Montessus de Ballore, who based his conclusions on a study of 45,000 earthquakes, seemed to show that when large numbers like these were considered, the periodicity apparent in individual lists tended to disappear; though, on the other hand, Dr. Davidson showed that within definite regions there is a distinct seasonal variation. Mr. R. D. Oldham, of the Geological Survey of India, has lately made a study of the records of earthquake shocks in Assam, which have been kept since 1897, the year of the great earthquake in that province; and the results of his inquiry are put forward in the *Journal of the Asiatic Society of Bengal*, vol. lxxi., 1902, pp. 139–153 (also issued as a reprint). Mr. Oldham points out that any effect which the attraction of the sun and moon may have will be mainly exerted by the tide-producing forces they set up, and he therefore briefly sketches the way in which these are exercised. If, he points out, we suppose the force exerted at any point to be resolved into two separate forces—one vertical, the other horizontal, the vertical force attains

its upward maximum where the satellite (the sun as well as the moon is regarded as such for the special purposes of this investigation) is in the zenith or nadir, and its downward maximum along the great circle at right angles to the line joining these points; while the horizontal force attains its maximum along two circles distant about 54° 44′ from the zenith and nadir respectively. Mr. Oldham then calculates, for 26° N., and for different declinations of the sun, the intervals, before and after midday and midnight, of the passage both of the circles of maximum tide-producing forces, and (which may be still more important) of the maximum *rate of change* of such forces; afterwards examining, side by side with the results, the actual *data* as to earthquake frequency which have been obtained. Into the details of the inquiry we cannot enter, but the general result is to show (1) that earthquake shocks in Assam were most frequent between 10 and 11 p.m., and between 6 and 7 a.m., though no satisfactory cause can be assigned for this distribution; (2) that there is another and smaller variation which has the appearance of being due to the tidal stresses set up by the attraction of the sun; and (3) that if this is really the case, the horizontal stress is much more efficient than the vertical, and the rate and range of variation of the stress, than its actual amount. These conclusions are to be regarded as provisional only until observations over a longer period are available.

The Dalai Lama's Residence at Potala.—Mr. Douglas Freshfield sends us the following note on a new representation of the Dalai Lama's palace: "Mrs. Le Mesurier, the wife of the English Resident in Ladakh, has sent me from Leh a photograph of an original drawing of Potala, the residence of the Dalai Lama at Lhasa, taken from an original drawing given to her by a Buddhist lama in Ladakh. The view is taken from the same direction as that published with Chandra Das's narrative, but appears to be somewhat more skilfully drawn, and while confirming the accuracy of the published print adds some additional details."

The Desert of Gobi between Hami and Suchau.- Dr. Futterer crossed this region in his journey through Asia, and has described it from a geographical point of view in considerable detail in the last number of the *Ergänzungshefte of Petermanns Mitteilungen* (No. 139), 1902. There are three different belts—(1) the northern flat depression, extending roughly from east to west; (2) the middle mountain zone of the Pe-shan; and (3) a southern longitudinal depression between the Pe-shan and the Nan-shan. The northern depression lies to the south of the Karluk-tag branch of the Tian-shan, is some 65 kilometres wide, and rises from 840 metres at Dachwantan, south of Hami, to 1700 metres, at the northern foot of the Pe-shan. Towards the west it deepens, to Shona-nor it rises, to sink again to the depression of Turfan. It is mainly covered with waste derived from both northern and southern mountains. Here and there are patches of loam and spots of vegetation where the water reaches. Slight elevations of old volcanic origin rise above the waste deposits, which overlie Tertiary fresh-water sediments as far as can be observed. The base of the Pe-shan or Bei-shan mountain zone is 1700 metres on the north, 1400 in the south, and 2130 metres in the centre. It consists of five more or less parallel ranges striking east-north-east and west-south-west, separated by wide, flat longitudinal troughs. The northern range is a continuation of the Chol-tag of the Tian-shan, and the southern is the easterly prolongation of the Kuruk-tag, which trends to the Tian-shan south of Bagrash-kul and Korla. The four middle ranges rise about 500 metres above the sockle—that is, about 2500 metres above the sea. The structure of this zone is complicated. It consists of old fold mountains, crystalline schists, and metamorphosed old Palæozoic sediments, broken by extensive Palæovolcanic rocks, granite, and diorite. Granite and porphyry are most important in the northern

and southern ranges. The higher middle ranges have vertical metamorphosed Palæozoic sediments and schists, and coal is found near the eastern route across them. The long wide troughs between the ranges are filled with rock waste, but here and there the old rocks are visible. There is little vegetation. Some grows on the loam in the valley openings, and at the base of the mountains or in the middle of the troughs, but none is found on the old diluvial waste, and only isolated bushes in the young dry valleys. Among the animals are the kulang, or wild ass (*Asinus kiang*), the *Equus Prjevalsky*, the argali (*Ovis poli*), the antelope *gutturosa*, the fox, the hare, and the red grouse. The southern trough is 50 kilometres wide and 1310 metres at the lowest point. It too is covered with waste from the mountains, both from the north and the south, with few elevations of old rock or crystalline schists rising out of it. Near the foot of the Nan-shan deposits of the Pliocene sea are found. Along the watercourses are cultivated oases, grass steppes, on the margin tamarisks, and then the pebbly desert zone. The lakes in the west receive the waters from the Nan-shan, but have no outlet. Those in the east form the Edin-gol, which runs past the Pe-shan zone to Sokho-nor.

The Inland Sea of Japan.—Dr. N. Yamasaki contributes a paper on the Setouchi, or inland sea of Japan, and particularly on its geological history, to the November number of *Petermanns Mitteilungen*. Three main aspects of the subject are dealt with—topography, structure, and the action of the tides. The inland sea communicates with the open ocean by four narrow straits—hence its name Setouchi, contracted from Setono-Uchiumi, "the sea within the straits." It is extremely shallow—the depths are usually less than 60 metres; islands are numerous. The coast-line is very irregular, and the different peninsulas and islands divide the basin into seven parts, named, in order from west to east, Suwô-nada, Iyo-nada, Aki-nada, Bingo-nada, Midzushima-nada, Harima-nada, and Osaka bay (Idzumi-nada). Dr. Yamasaki describes the form and structure of each of these divisions in detail, and an excellent map accompanies the paper. In order to understand the general relations of the whole basin, it is necessary to bear in mind that the Japanese group of islands is constituted by two main arcs which meet in the middle of Hondo and form a *Scharung*. The western half of Hondo and the two large islands Shikoku and Kiushiu belong to the southern arc, which presents its convex side to the Pacific, and consists of an outer and inner zone. The Setouchi is a large fracture subsidence in the inner zone of this southern arc, and the subsidence can be traced north-eastward across the Osaka plain, through the valleys of the Yodo-gawa and the Yamato-gawa, to the Biwa lake in the province of Omi. The small peninsulas and islands, the isolated hill-ranges on the land, and the large island of Awaji, represent elevations dotted over the sunken surfaces. Successive subsidences have been partly filled up, sometimes with volcanic material, sometimes with fluviatile, and only the long picturesque strip of the Setouchi remains submerged. As already stated, the inland sea of Japan is, for the most part, very shallow. Deep holes occur, but these are always found in narrow channels, never in open water. In the Bungo straits, the south-western entrance to the Setouchi, the deepest sounding of 300 mètres has been obtained. From there a trough runs north-eastward to the middle of the Iyo-nada, and in the Aki-nada, which contains many islands, there are many small pools 100 mètres or more in depth. Similar holes are found in the island region between the Bingo-nada and the Harima-nada, and off the three promontories of the Awaji island, which form three narrow straits with the mainland of Hondo and the island Shikoku. A typical channel in the Akashi strait, and two deep holes in the Naruto and Yura straits, are also remarkable. Dr. Yamasaki attributes all these submarine forms to tidal action, and discusses the tidal streams in the various channels in detail.

The Latest Crossing of Celebes by Messrs. Sarasin.—We referred a few months ago (vol. xx. p. 229) to the latest journey of exploration undertaken in Celebes by Messrs. Sarasin, and to the project formed by the explorers of a journey across the little-known regions in the western centre of the island. A note in *Globus* for January 15 announces the successful completion of this journey, which was made from Palu (Palos), on the west coast, to Paloppo, on the Gulf of Boni, or from north to south instead of in the contrary direction as at first reported. From Palu, the valley of the Palu river, first penetrated by Messrs. Kruijt and Adriani in 1897, was ascended, and a visit paid to Lake Lindu, also reached by the explorers just mentioned. The lake is only about 5 miles long, but is very picturesque, and is bounded on the east by the high range of Ngilalaki. Its altitude is some 3250 feet, and its maximum depth was found to be 213 feet. Trouble with the natives necessitated an appeal to the Governor of Celebes, whose energetic action enabled the travellers to continue their journey after some delay. Crossing the watershed of the Palu river, they entered the basin of a much larger stream, the Koro, which astonished them by its size and depth at this distance from the sea. Only its mouth, near Lariang, has hitherto been known, though it appears to be the most important river of western Celebes. The route was a difficult one, passing through an almost uninhabited region, now high up above the river on the steep mountain-sides, now among the rocks in its bed. Crossing a range to the east, the travellers reached a peculiar plain 2600 feet above the sea, surrounded by mountains and having the appearance of being due to local subsidence, in which many earthquakes have been experienced within the last two years. The plain contains many villages. Hence the route ascended the wooded Topapu range to the open plateau of Leboni, some 3250 feet above the sea, where the thermometer sank as low as 52° Fahr. South of Leboni the mountains, which possessed a rich flora and an uncommon bird-fauna, increased in height, and on the fourth day a view was obtained of a high mountain in the east, named Koruve, which is considered to be the highest yet known in Celebes being estimated at over 10,000 feet. The route finally led down into the valley of the Baliase and over a well-cultivated plain to the Gulf of Boni. Interesting collections were made in the departments of ethnology, zoology, botany, and geology, while positions were fixed astronomically and heights determined by boiling-point observations, the result being to considerably modify the map of west central Celebes.

AFRICA.

The Livingstone Memorial: Initials at Garden Island.—Writing fron Zomba on December 17, Mr. Alfred Sharpe informed us of the completion of the monument which has been erected to the memory of Dr. Livingstone on the site of the great explorer's death, sending also a photograph of the monument, which we here reproduce. The work, Mr. Sharpe says, has been excellently carried out by Mr. Codrington, to whom much credit is due for his energy in the matter. It is considered very suitable for the situation, and is made of well-burnt bricks, thickly coated with cement; while there are no flat surfaces on which rain can lodge, so that it may be expected to last for many years. There will be a considerable balance from the sale of the cement not needed for the work, and this it is proposed to spend on the erection of a native hospital, to be known as the "Livingstone Memorial Hospital," at Fort Jameson, the nearest European settlement to the spot where the explorer breathed his last. A letter from Major Coryndon to the secretary of the British South Africa Company, describing a visit to Garden island by Mr. Sykes, District Commissioner at the Victoria falls, has also been courteously placed at our disposal. It may be remembered that when Garden island, which

lies in the centre of the river just above the falls, was first visited by Dr. Livingstone, the explorer, for the first and last time in Africa, cut his initials on a tree, adding the date 1855. During the second Zambezi expedition, Mr. Charles Livingstone added his initials, with the date 1860 and the Government broad arrow, below those of his brother; while Mr. W. C. Baldwin, who visited the spot while the Livingstone expedition was there, states that he also cut his initials on

LIVINGSTONE MEMORIAL.

the same tree. Garden island was visited soon afterwards by Baines, but in recent years no one appears to have been on the island until it was visited by Major Coryndon and Mr. G. Grey, who, however, failed to find the inscription, in spite of careful search. Mr. Sykes was guided to the spot by an old native, and found that the letters, though not very plain, were unmistakable. The bark is rough, and the date is now undecipherable.

The Condition and Prospects of Rhodesia.—During the latter part of 1902, Mr. J. F. Jones, joint manager and secretary of the British South Africa Company, made a journey through Rhodesia, in company with three of the directors, studying especially the commercial condition of the territory. His report, issued in February last, gives some useful information on the present position as regards the development of the resources of Rhodesia, of the value of which he has formed a high opinion. The country, he holds, is steadily recovering from the stagnation caused by the late war, and progress and prosperity, founded upon a sure basis, are now in sight. The facts put forward in the report seem certainly to justify a favourable view of the progress so far made and the possibilities for the future. The primary need of a new country, viz. easy means of communication, has been well supplied by the extensive railway system, either already existing or under construction, the mileage now amounting to 2193 miles, while so carefully have the needs of the country been considered in the location of the lines that on the completion of the various branch lines now projected every mine of importance now at work in Rhodesia will be within 20 miles of a railway. The principal extension now under construction is that from Bulawayo *viâ* the Wankie coalfield to the Victoria falls and the mining districts of the Kafue, which may eventually be continued through north-eastern Rhodesia to Lake Tanganyika.* Branch lines are also being made from Bulawayo to the Gwanda goldfields, and from Gwelo to the Selukwe district; while a line will also be made from Salisbury to the Mazoe district so soon as the survey is completed. The construction and equipment of the railways is said to be excellent, while their working, no less than that of the mines, will be enormously benefited by the existence of an inexhaustible supply of excellent coal, which is now assured. On the arrival of the line at the Wankie coalfield, probably in the present month, it is stated that a daily output of 300 tons will be at once available, and this may be increased, if necessary, to 1000 tons daily, the coal being equal to any, except the best Welsh, for steam purposes. Hitherto wood has been largely used, and in many parts the country has been cleared of timber, but planting is now being carried out to replace this. As regards the mineral wealth, it is expected that the output of gold will be doubled in a few years, while there are vast deposits of copper, lead, zinc, and iron in the Kafue region, those of the first three promising to rank among the richest in the world. The enormous water-power available at the Victoria falls will probably be utilized in course of time to generate electricity for conveyance to the mines. Lastly, as regards the agricultural resources, a large part of the surface consists of a rich red loam, capable of growing anything, and as the country is extremely well watered, irrigation has rarely to be resorted to in order that two crops may be reaped in the year. With the industrial development of the country, markets for produce of all kinds are extending.

Geodetic Work in South Africa.—In speaking of the Report for 1901 of the astronomer at the Cape (*Journal*, vol. xx. p. 453), we recorded the extension to the Zambezi during that year of the geodetic arc of the meridian now in course of measurement, and the approaching commencement of work north of the river. Arrangements for this have since been completed, and the direction of the work has been put into the hands of Dr. Rubin, of Upsala, who last year superintended the completion, by the Swedish party, of the measurement of the arc in Spitsbergen. Dr. Rubin was in this country, *en route* for South Africa, about the middle of March.

* No reference is made to the proposed northern line into the Congo State, about which a good deal was said last year in the daily press.

Railways and Boundaries in West Africa.—Among the many recent schemes for railways in the West African colonies and protectorates, one of the latest set on foot is that for a line from Thies, a point on the Dakar-St. Louis railway, in the French colony of Senegal, to Kayes, the starting-point of the railway to the upper Niger, which has been under construction for so many years. According to a note in the *Mouvement Géographique* for February 15, a survey of a line of route for this railway, which it is proposed to carry through the Jolof country, Bondu, and Bambuk, is about to be commenced. It is not thought that the ground will cause many difficulties, though want of water over a part of the route may make itself felt. Serious steps have also been taken in Germany towards the construction of a railway from the coast into the Kamerun hinterland, to be carried ultimately, it is hoped, to Lake Chad. A syndicate, formed in Berlin, last year despatched an expedition under Herr Robert Neumann for the survey of various suggested lines of route, and it has lately returned after completing its labours. We learn from the *Geographische Zeitschrift* (1902, No. 11), that one of the suggested lines starts from Victoria, and runs by Mundame to Tinto and Bali; another makes the capital, Duala, its starting-point, but from Mundame onwards coincides with the first; and a third strikes inland from Duala by a more southerly route, to Yabassi and Tibati. From the *Deutsches Kolonialblatt* for March 1, we gather some details respecting the survey, now in progress, of the boundary between the Kamerun and French Congo. The German members of the commission, Captain Engelhardt and Lieut. Förster, had separated last October at the Ngoko station, the former proceeding in steamers up the Sanga and Kadei, with a view to continuing up the latter in canoes, and making his way overland to Bertua; the latter proposing to follow the Sanga to Bania, and then march to the coast by way of Gaza and Kunde, determining the positions of these three places, on which the line of the boundary will in great measure depend. For the demarcation of the northern Kamerun boundary with Nigeria, a joint expedition set out in January, the British commissioner being Colonel L. C. Jackson, R.E., the German, Captain Glauning, who has already done much good work in East Africa. The boundaries between Nigeria and the French Sahara, and between the Gold Coast and Liberia will also be demarcated during the present season.

A Survey of Lake Chad.—We learn from the *Politique Coloniale* of March 4, that a careful survey of Kanem and Lake Chad has been carried out by Lieut.-Colonel Destenave and the officers under his orders, and that the results have been received by the Paris Academy of Sciences. The whole of the French portion of the lake is said to have been minutely surveyed, so that its contours will now for the first time be known with any accuracy.

AMERICA.

Mount McKinley, Alaska.—Reference has been made in the *Journal* to the expedition to the region of Mount McKinley, the highest known point of North America, carried out last summer by Mr. A. H. Brooks, of the United States Geological Survey. The official report on the journey is still in preparation, but Mr. Brooks gives, in association with Mr. D. L. Raeburn, who also took part in the expedition, some notes on the mountain and its neighbourhood while discussing plans for its ascent in the January number of the *National Geographic Magazine*. The Alaskan range, in which Mount McKinley occurs, is a rugged mountain mass running north-east from the vicinity of Lake Clark, and forming the watershed between the Sushitna river and Cook inlet on the south-east, and the Kuskokwim and Tanana on the north-west. On the east and south it rises by a series of foot-hills from the Sushitna, and on the west it falls abruptly to a gravel-floored plateau,

which slopes gradually towards the Kuskokwim. In addition to Mount McKinley, over 20,000 feet in height, it contains Mount Foraker, 14 miles to the south-west, about 17,000 feet, as well as a number of peaks of from 10,000 to 14,000 feet in the north-east. McKinley, which lies in about the centre of the length of the range, but much nearer the western than the eastern margin, is dome-shaped, and has two summits 2 miles apart, the southernmost being the higher by some 1000 feet. The north-western slope is drained by a large glacier, which discharges into a tributary of the Toklat (basin of the Tanana). An expedition for the purpose of climbing the mountain should approach from this side, both because the peak lies towards that side of the range, and because the gravelly plateau above alluded to is for the most part above timber (the upper limit of spruce is about 2500 feet, though willow sufficient for fuel is found up to 4000), and affords ready access to the base of the mountains where good grass is plentiful. The snow-line is at about 7000 feet instead of at sea-level as in the case of Mount St. Elias, and the writers consider that the actual ascent would present no exceptional difficulties, the long and difficult journey to the base being a more serious matter. Alternative plans for a summer expedition are (1) to cross overland from Cook inlet to the Kuskokwim headwaters, and then follow the base of the range north-east; (2) to proceed by Dawson and the Yukon to the mouth of the Tanana, ascending that river and its tributary, the Toklat, as far as possible. But in order to reserve the strength of the party for the actual ascent, the writers favour the idea of wintering in the region, and transporting the supplies to the base of the mountain during the winter and spring by the help of dogs.

AUSTRALASIA AND PACIFIC ISLANDS.

Memorial to Captain Collett Barker in South Australia.—Captain Collett Barker, of the old 39th (Dorset) Regiment, went out with that regiment to Australia in 1825, and though his career was brought to a tragic close only six years later, had during that interval given proofs of energy and determination which promised much for his future achievements as a pioneer in that then virgin country. As it was, he did some valuable work in this direction, which has lately been fittingly commemorated by the erection of a monument at the township of Mount Barker, near the scene of his untimely death. The *Adelaide Observer* of January 24 contains an account of the ceremony at the unveiling of the memorial, giving also a short account of the journey which proved fatal to the explorer. It was undertaken in 1830, during a voyage from King George's sound to Sydney, with a view to completing the exploration of the neighbourhood of the mouth of the Murray lately carried out by Sturt, who was an officer in the same regiment. Landing on the east shore of St. Vincent gulf, Captain Barker proceeded inland to Mount Lofty, discovering the second high peak in this neighbourhood which now bears his name, and thence went to the mouth of the Murray to ascertain whether it had any other outlet than that discovered by Sturt. He swam across the river alone, and was never afterwards seen by his companions, who, however, obtained almost certain proof that he had been murdered by natives. The monument, an illustration of which is given in the *Observer* for January 31, is an obelisk of polished Carrara marble, mounted on a base of rough-hewn granite.

Surveys and Forestry in New Zealand.—In the report of the Department of Lands and Survey, New Zealand, for 1901-02, Mr. Marchant, the Surveyor-General, refers to the question of a national survey, to be executed in accordance with the best modern geodetic methods, the importance of which has frequently been urged in the colony. He points out that New Zealand is wealthy and prosperous; that the greatest facilities are afforded for communication, while former

tedious and expensive processes have been superseded and instruments made more portable; and that there are capable and energetic officers eager to undertake the work. He therefore suggests that the time has come for at least making a beginning with such a survey, which would be valuable as contributing data for the determination of the exact figure of the Earth. Some account is also given of the progress hitherto made with the magnetic survey of the colony, begun in 1899. During the last year the survey has been in abeyance, as the attention of Dr. Farr and his assistant has been devoted solely to observatory work, but the importance of a resumption of field work is strongly urged. Dr. Farr describes the newly erected observatory and the work done in it, as well as the arrangements for co-operation with the British Antarctic Expedition as regards magnetic work. A memorandum is also given on the longitude of the Mount Cook Initial Station, Te Aro, Wellington, the point to which the New Zealand surveys are referred. A full statement is given of the steps which have been taken at various times to determine this and other longitudes in New Zealand, and it is shown that, by the recent telegraphic determinations of the longitude of Sydney observatory, and of the difference between that observatory and Mount Cook, a correction of $-0{\cdot}4^{s}$ on the value, $11^{h}\ 39^{m}\ 9{\cdot}22^{s}$, hitherto used for Mount Cook Initial Station, is found to be necessary. The report on Forestry operations states that the total area of artificial plantations is 853¾ acres, and the total number of trees in the nurseries 5,982,710, valued at over £10,000. A comprehensive scheme for forest conservation and planting is said to be in course of preparation, the general cry being once more repeated that the native forests are being rapidly denuded, and that protection and provisions for the future are matters of urgent necessity.

POLAR REGIONS.

Relief Expedition for Baron Toll.—A relief expedition, consisting of six sledges drawn by dogs, has started from Eastern Siberia to New Siberia, under the command of the engineer Brusneff, for the relief of Baron Toll. Moreover, Lieut. A. V. Kolchak, recently returned from the New Siberia expedition, must have also left Siberia by this time with the same object. His expedition, consisting also of a number of sledges drawn by dogs, will proceed to New Siberia *viâ* Ust-Yansk and Kazachiye. If Lieut. Kolchak does not meet Baron Toll in New Siberia, he will march, on the ice, to Bennett Land, it being known that Baron Toll, when he left the *Zarya* on July 6 last in the Nerpichiya bay of Kotenyi island, intended to proceed *viâ* Faddéeff island and Cape Wussokyi to reach, on the ice, Bennett Land, and there to carry on scientific work. He was accompanied by the astronomer, F. G. Seeberg and two Yakutes. He had two *baidaras* (boats) for crossing the open spaces amidst the ice, and it is supposed that he may winter on Bennett island. The zoologist Birula, who was at first reported to be likewise cut off from return to the mainland, has, it appears, safely reached Irkhutsk, having left New Siberia on December 4. He states that Baron Toll reached Cape Wussokyi on July 10, and after depositing a record stating that his party was well, started again for Bennett Land.

Arctic Expeditions in 1903.—Undaunted by his previous unsuccess in his endeavour to reach the pole, Commander Peary is already planning a new expedition, which, he says, he will proceed to organize so soon as he can secure the necessary funds. He is said to be searching for a suitable vessel for his purpose. The expedition to be despatched this year by Mr. Baldwin by way of Franz Josef Land will make a final start from Tromsöe, for which port the *America*, commanded by Captain Coffin, sailed from New York about the middle of March. The leader of the expedition, Mr. Anthony Fiala, has reached England *en route* for Tromsöe, but will, it is said, return to America to collect his scientific staff before finally sailing.

German Auxiliary Expedition to the Antarctic.—The example set in this country by the despatch of the *Morning* to the antarctic is to be followed, it appears, in Germany, where a movement is on foot for the despatch of a relief expedition during the present year, in case no news of the main expedition should be received by June 1. According to *Petermanns Mitteilungen* (No. 1, 1903), a sum of £24,250 has been placed on the estimates for the current year for the fitting out of such an expedition.

GENERAL.

Geography at British Universities.—The first number of the *Geographical Teacher* for the current year summarizes in a useful way the present state of geographical teaching at the British Universities, the various arrangements as to lectures, courses of study, examinations, etc., in force at each being fully stated. While the list brings out the regrettable deficiency which still exists as regards chairs in geography, the much-needed endowment of which would enable a certain number of men to devote their whole energies to the study and teaching of geography, and so do more than anything else to obtain recognition for the subject as an independent branch of education, there is much which goes to show that progress is being made all over the country with the organization of geographical teaching, and presents on the whole an encouraging picture as compared with the state of things fifteen or twenty years ago. By continued exertion, we may hope that before very long still more decided results will be obtained.

Geography in the University of Chicago.—The University of Chicago has established a Department of Geography, and Prof. Rollin D. Salisbury, of the Department of Geology, has been placed at its head. The arrangement between the Departments of Geology and Geography is such that Prof. Salisbury retains his connection with the former, as heretofore, at the same time that he assumes the headship of the latter. The close connection of the two departments appears from the fact that Prof. Salisbury will also act as head of the Department of Geology when Prof. Chamberlin is not in residence, and Prof. Chamberlin will act as head of the Department of Geography in Prof. Salisbury's absence. The Department of Geology has heretofore offered courses, both elementary and advanced, in Physical Geography, and elementary courses in Meteorology. Other courses of a geographic character have been offered by other departments, notably Geographic Botany by the Department of Botany, Zoögeography by the Department of Zoölogy, and Commercial Geography by the Department of Political Economy. These courses will continue to be given as heretofore by these several departments, except that Meteorology will be under the auspices of the new department. The new department will not duplicate the geographic courses already given, but will, at the outset, provide courses which supplement those already established. The immediate aim of the new department will be to occupy the ground intermediate between Geology and Climatology on the one hand, and History, Sociology, Political Economy, and Biology on the other. The courses offered at the outset will be those for which, within this field, there is greatest demand. John Paul Goode, PH.D., in charge of the work of Geography in the Wharton School in the University of Pennsylvania, has accepted an assistant professorship in the Department of Geography, and will begin his work the second term of the Summer Quarter (July 27, 1903). No other appointment will be made this year. During his first year, Dr. Goode will be in residence during the second term of the Summer Quarter, and during the Autumn and Spring Quarters. The courses which he will give during the first year will include courses on the Economic Geography of (1) North America, (2) Europe, and (3) Tropical Countries. The central theme of these courses will be the influence of the physiography, the climate, and the

natural resources of these lands on their settlement, development, and present commercial and industrial status. Research courses will also be offered for advanced students. The geographic work of the university during the coming year will include the following courses, in addition to those given in the Department of Geography :—I. In the *Department of Geology*— (1) An elementary course in Physiography each quarter; (2) A local field and laboratory course, first term Summer Quarter; (3) Two field courses in Geology and Geography about Devil's Lake and the Dells of the Wisconsin, in Wisconsin, one month each, commencing June 18 and July 27 respectively; (4) A course in advanced Physiography, Autumn Quarter; (5) A field course (for advanced students) in the Wasatch mountains of Utah and vicinity. Other courses which, while primarily geological, are fundamental to the proper conception of the evolution of the present geography of the continents, will also be given in this department. II. In the *Department of Zoölogy*—Courses in Zoögeography, Summer and Spring Quarters. III. In the *Department of Botany*—(1) An elementary course in Plant Geography (time not announced); (2) An elementary course in Ecology, Summer and Spring Quarters; (3) Elementary and advanced courses in Field Botany, Summer and Spring Quarters; (4) Advanced courses in Geographic Botany, Winter Quarter; and (5) A course in Physiographic Ecology, Summer and Spring Quarters. IV. In the *Department of Political Economy*—Courses in Commercial Geography, Summer, Autumn, and Winter Quarters. In addition to the foregoing, courses in Geography will be given by Miss Babor in the School of Education (the Normal Department of the University). These courses are planned primarily with reference to the needs of teachers in the grades. Miss Baber will also conduct a field course of one month's duration during the second term of the Summer Quarter, beginning July 27.

International Geological Congress, 1903.—We have received further details of the programme of the International Geological Congress to be held in Vienna in August next (see *Geographical Journal*, December, 1902, p. 660). There will be discussions on the "overfolded" or "overthrust" sheets ("verschobenen Tafeln," "nappes de charriage," "lambeaux de recouvrement"), which play such an important part in the structure of the mountains of Scotland, the Jura, and the Alps; and on "Klippen." In these, Messrs. V. Uhlig, M. Lugeon, F. Toernebohm, Bailey Willis, and F. Kossmat are expected to take part. A special sitting will be devoted to questions concerning the geology of "The Balkan Peninsula and the East," when papers will be read by Messrs. F. Toula, V. Hilber, J. Cvijić, G. von Bukowski, F. Katzer, and A. Philippson. Mr. F. X. Schaffer will contribute a paper on the soil (*Boden*) of the town of Vienna. The extensive engineering works carried out in the city and neighbourhood during the last ten years have exposed many deposits which have led to important discoveries by Prof. Suess. The paper will be illustrated by a large geological map on a scale of 1 : 10,000, and numerous sections.

OBITUARY.

William Henry Crosse.

William Henry Crosse, M.D., F.R.G.S., died in London on February 24, at the comparatively early age of forty-four, through illness resulting from his residence in Africa. He was probably best known to Fellows of the Society generally by the Medical Hints published in the 'Hints to Travellers.' This chapter (VII.), elaborated by Dr. Crosse with characteristic care, is of special value to residents

and travellers in tropical countries, owing to Dr. Crosse's long personal experience of Equatorial Africa and his subsequent practice in London as a consulting physician in cases connected with tropical diseases.

He was the son of the present Vicar of Terrington St. Clement. He was born at Lucan, Dublin, and educated at St. John's Foundation School, Leatherhead. At the age of seventeen he entered Guy's Hospital. After leaving the hospital, a small practice in Cubitt Town was bought by him. Such was his skill and energy that in five years his income rose from £300 to about £1500, a fine result for a young man who was too modest and retiring to be an adept in the art of self-advertisement. Illness, through overwork, compelled him to relinquish his practice; but after voyages to China and other parts of the world, he recovered his health.

At that time (1886) the Royal Niger Company had just received its charter, and was seeking for an able and energetic head of its medical staff. This post his exceptional testimonials secured for him, and he passed most of the following nine years in what is now known as Southern Nigeria. He paid two or three brief visits to England, and travelled extensively in Northern Nigeria when his duties required it; but, as principal medical officer, his official residence was at Asaba, the seat of the company's civil administration. There he was able to employ his scanty leisure in the interesting study of the pagan tribes of that region, and in compiling more than one useful treatise on malarial fever and other tropical diseases. His surgical skill was also of great value, as there was scarcely one of the company's numerous military expeditions, from 1886 to 1895, in Southern Nigeria in which he did not take part. These were to him the most interesting years of his life. Although, after his return to London in 1895, he gradually built up a good practice, he more than once contemplated a return to Nigeria, where his sympathetic nature and his unwearying care for his patients will be remembered with affection and regret by all who knew him.

Dr. Crosse was also much interested in natural history, and made collections whenever the chance was offered, insects being his particular favourites. The first series from his collections was presented by him to the British Museum, and the second set he gave to the Hope Museum at Oxford. One of the most beautiful of West African butterflies has been named after him, *Euphædra crossei*, by Miss E. M. Bowdler-Sharpe.

George Taubman Goldie.

Prof. Poulton has kindly sent the following notes:—

The few hundred insects presented by Dr. W. H. Crosse to the Hope Museum range over many orders, the Coleoptera and Rhynchota Hemiptera being the most numerous. Although it is improbable that there are many rare species, the whole collection forms an interesting assemblage eminently characteristic of the West African sub-region. The relative predominance of mimetic associations among the Ethiopian Lepidoptera Rhopalocera is well shown. In a series of under 90 specimens the following interesting examples occur: three specimens of *alcippus*, the white hind-winged form of *Limnas chrysippus*, with *Hypolimnas misippus*, both male and female. The latter is the type form mimetic of the type form of *chrysippus*, which does not occur in this part of Africa. Of the genus *Amauris*, only *A. egialea* appears in the collection (three specimens), although examples of *Papilio merope* are present, three of them females of the form which is a beautiful mimic of *Amauris niavius*. A single specimen of *Euralia dubius* is of the form with a reduced white patch at the base of the hind wing, a mimic of *Amauris hecate* and certain varieties of *A. psyttalea* (= *damocles*, *enceladus*). There is also a specimen

of *Neptis agatha* and the convergent *Neptidopsis ophione*. *Acræa lycoa*, of which there are two specimens, has probably approached the black and white species of *Amauris*, such as *egialea* and *psyttalea*. The pale green spotted *Papilio leonidas* is represented by a single example, although its mimic, *Tirumala petiverana*, is absent. The important synaposematic group of large black and red *Acraeinæ* is represented by *A. pharsalus* (1 ♂, 2 ♀), and *A. zetes* (2 ♂). But it is in the *Pierinæ* that the predominance of mimetic resemblance is most obvious. Out of twenty-six specimens, no less than ten, of various genera and species, exhibit the black marginal spots, which are probably in all cases to be traced to the influence of the dominant distasteful genus *Mylothris*.

The series of Rhynchota Hemiptera contain several large conspicuously coloured species of *Reduviidæ*, and convergent colours and patterns are obvious within the order, as well as between it and the Lycid Coleoptera. The chief representatives of the latter order are many fine and characteristic West African species of Longicornia, Cetoniidæ, and Heteromera.

The chief interest of the collection is probably the evidence that it supplies of the relative importance of bionomic principles, and especially Müllerian mimicry, as determining factors in the evolution of colour and marking.

Dr. Karl Ritter von Scherzer.

The Society has recently lost one of its most distinguished honorary corresponding members in the person of Dr. Karl von Scherzer, best known to geographers as the head of the scientific staff of the *Novara* during the voyage round the world in 1857–59, though his work in this connection, valuable as it was from a scientific point of view, formed but a small part of his restless and many-sided activity. The following brief sketch of his life is mainly based on a biographical notice, issued little more than a year ago in Vienna, as the first instalment of a "Gallerie denkwürdiger Personen der k. k. Hof- und Staatsdruckerei," in which establishment Dr. Scherzer commenced his career.

Scherzer's ancestors were formerly settled at Eger in Bohemia, but in Reformation times were, as Protestants, forced to leave their fatherland, moving from one place to another, until in 1796 the father of our late associate, then twenty years old, took up his abode in Vienna. His son Karl was born in 1821, and in 1834 entered the Government printing-office as an operative. Although his connection with this establishment ceased three years later, he remained more or less in touch with the printing and publishing trade for some years, during which he completed his education by extensive foreign travel. In 1848 he championed the cause of the Vienna printers, and it was through his energetic advocacy that a revision of the scale of charges and other advantages were secured by the trade in that year. For his attitude on this and other questions he was regarded with suspicion by the authorities, and was twice brought before a court-martial to answer for his conduct. It was about this time that he formed the acquaintance with Dr. Moritz Wagner, which turned his thoughts in the direction of more extended travel. The two friends sailed for New York in 1852, and spent the next few years in researches—political, economical, and scientific—in the United States, Canada, and the Central American republics. In the last named, then very imperfectly known in Europe, results of great value in regard to the geography, natural history, and ethnology of the several states were obtained, and, among other studies, the ruins of Quirigua were visited, and collections made on behalf of the British Museum. In 1855 and 1856 Scherzer devoted himself to the working up of his material, besides contributing largely on more general subjects to the *Allgemeine Zeitung* of Augsburg

and to Peschel's *Ausland*. His writings brought him to the notice of the Finance Minister, who introduced him to the Archduke Ferdinand Maximilian, the result being his appointment, in November, 1856, to the scientific commission of the *Novara*, then being fitted out for the famous voyage, which lasted from April, 1857, to November, 1859. Before starting, Scherzer took great pains to qualify himself for his task by correspondence with Darwin, Lyell, Murchison, Haeckel, and other scientific men, and the results obtained were, as is well known, of very great value, not only from the scientific point of view, but from that of commerce and statistics, which fell within Scherzer's more particular sphere.

Scherzer's services were secured, in 1866, for the Austrian Ministry of Commerce, with which he remained connected, in one capacity or another, until his retirement in 1897, the value of his work being repeatedly recognized by decorations and other honourable distinctions. Before representing his country as consul in many important centres, including Smyrna, London, Leipzig, and Genoa, he took part in another important voyage, that of the *Donau* and *Friedrich*, despatched to the Far East in 1868 mainly for political and commercial objects. Scherzer made a special study of the Suez canal, then under construction, and, after visiting the chief centres of Indo-China, China, and Japan, crossed the Pacific and prosecuted his mission in California, Central America, Peru, and Chili, subsequently embodying the material collected in valuable reports and memoirs. His last important work, entitled "Das Wirtschaftliche Leben der Völker," was published at Leipzig in 1886. After his retirement from active work, he resided principally at Görz, and was latterly engaged in writing his varied reminiscences.

Dr. Josef Chavanne.

The well-known Austrian traveller and geographer, Dr. Josef Chavanne, died in December last at Buenos Aires, after an illness of some months. Dr. Chavanne was of Walloon extraction, and was born at Graz in 1846. His taste for geography and travel was first gratified in 1867, when he undertook an extensive journey through the Western States of the American Union, Central America, and the West Indies, ending up with a visit to Morocco and the Northern Sahara, then very much less known than they are now. The work in which he, some years later, embodied the results of his African researches, entitled 'Die Sahara, oder von Oase zu Oase' (Vienna, 1879), was at the time a contribution of some importance to our knowledge of Northern Africa. A few years later, in 1883, he undertook a journey to the Congo, the results of which he published under the title 'Reisen und Forschungen im alten und neuen Kongostaate' (Jena, 1887). A large part of his reputation as a geographer was, however, the outcome of scientific work at home. He resided for some years in Vienna, and for a time edited the *Mitteilungen* of the Geographical Society in that city. He published a Physical and Statistical Atlas of Austria-Hungary, and physical and other maps of the parts of the world of which he had made a special study. During the latter years of his life he devoted himself especially to the geography of Argentina, where he had held an appointment in the Hydrographical Office since 1895. Before this date he had done an important work in preparing, for the State Railway Administration, a map of the whole country on the scale of 1 : 1,000,000, on which, as well as the railways, the surface features of the country were carefully laid down. He also published a work on the climatology of Argentina, and for some time before his death had been engaged on an important study on the Andes.

CORRESPONDENCE.

The Geographical Training of Army Officers in the Universities.

At the present moment, when schemes for the more efficient training of officers are discussed on every hand, it may not be amiss for a geographer to outline, in the briefest way, his conception of how geography should be utilized in the training of an officer for the army.

That the officer on active service has to fight in a *real* world is, of course, obvious. The distribution of his troops depends, not merely on the distribution of the opposing troops, but also on the character of the region in which he finds himself—that is, on the distribution of surface relief, of water, of vegetation, and of routes. In the wider planning of a campaign, the general configuration, climatic and economic conditions of the region have also to be considered—that is to say, the geographical conditions as a whole. The importance of a single one of these conditions—topography, is partially realized, but the significance of the geographical factor as a whole is almost invariably overlooked. For lack of such instruction our officers are forced to acquire this knowledge by the most expensive of all methods, the empirical one of muddling out right in the end. This costly policy, with its concomitant waste of money and life, might be in a measure avoided if our future officers received a more scientific training in geography.

For a successful training in geography at a university, it is essential, in the first place, that the university military cadet should possess a sound preliminary knowledge of the subject before beginning his university course, and this must of course be acquired at school, unless the time at the university is to be wasted on teaching the veriest rudiments of the subject. This school work should include practical as well as book work, and a certificate should be required stating that the candidate has spent a minimum number of hours in practical work, in the field and in the school. The habit of observing the character of the surrounding country cannot be begun too early, and this, together with the power to read and construct an ordinary map, and a knowledge of the outlines of general geography, should be the necessary preliminary to any university study. There is no need to organize new machinery for the purpose. The syllabuses of the Senior Local, Joint University, and Leaving Certificate examinations need only be improved, and have this condition of practical school work attached as a preliminary to examination.

In the university course the geographical teaching might with advantage be specialized along three lines—regional, historical, and cartographical.

(1) The geographical course proper would include—(*a*) a general course dealing with the natural regions of the world, with special reference to the distribution of relief, rivers, routes, and strategic centres, and the ensemble of conditions forming what may be called the configuration control; (*b*) the sum of conditions forming the climatic control, with special reference to such phenomena as the incidence of seasons, frost periods, seasonal rains, winds, floods, etc.; and (*c*) with the sum of factors forming the economic control. In addition to this general course, army candidates should be expected to show a detailed knowledge of the characteristics of the topography of typical land-forms, and of all the geographical conditions of a prescribed region, and this should be completed by a ten or fifteen days' excursion through the regions in question. Naturally the parts of the British Isles and the nearer portions of the Continent would be chosen for this purpose.

(2) In the historical course, which exhibits the effect of geographical conditions on military movements in the past, the same order would be pursued—a general course dealing with the broad outlines of the historical military geography of Europe would be followed by the detailed study of a prescribed campaign, as,

for example, one of the campaigns of Napoleon, the American civil war, the Franco-German war, the Russo-Turkish war, or the Boer war.

(3) The cartographical course would deal with the construction of topographical maps, the use of common surveying instruments, and practice in (*a*) mapping natural features, (*b*) range-finding, and (*c*) the elements of position-finding. In the case of engineers, geodetic surveying would be added.

In order to interfere as little as possible with other university work, the courses should be spread over three academic years. During the first, the outlines of geography and military topography might be studied; during the second, the outlines of historical military geography and typical land-forms; and during the third, the detailed geography of selected regions and campaigns. For the future engineer, who would have to make as well as to use maps, advanced courses in surveying and geodesy would be necessary.

In such university courses the object should be to make the cadets familiar with the general principles and facts of geography, with the sources of information, with the many notations in which geographical data are recorded, and as far as possible with half a dozen typical districts, each having different topographical characteristics.

Summary.

Geographical	A. Outlines of geography	(*a*) Configuration and routes.
		(*b*) Climatic.
		(*c*) Economic.
	B. Detailed topography of typical land-forms.	
	C. Detailed geography of a typical region.	
Historical	A. Outlines of historical military geography.	
	B. Detailed history of a prescribed campaign.	
Cartographical	A. Accumulation and recording of data. Surveying and map-making.	
	B. Interpretation of data. Map-reading.	

A. J. HERBERTSON.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1902–1903.

Eighth Ordinary Meeting, February 23, 1903.—Sir CLEMENTS MARKHAM, K.C.B., F.R.S., President, in the Chair.

ELECTIONS:—*Edwyn Barclay; G. Beach Chester; Athol Chichester; Robert James D'Arcy-Irvine; Emil Ernst; Marcus John Eustace, M.D., D.Ph.; John Foster Fraser; Guy John Fenton Knowles, C.E.; Captain C. H. Ley, R.E.; William Cameron Mackay; Charles Godfrey Moule; Henry Francis Previté, M.A.; Colin Skittal Reddie; Captain Cecil B. Simonds, R.G.A.*

The Paper read was:—

"Further Explorations in the Canadian Rockies." By Prof. Norman Collie, F.R.S.

Ninth Ordinary Meeting, March 9, 1903.—Sir CLEMENTS MARKHAM, K.C.B., F.R.S., President, in the Chair.

ELECTIONS:—*William Sloane Accles; Captain Lionel Edmund Anstey-Bennett (Paget's Horse); Lieut.-Colonel T. Capper (East Lancashire Regiment); Captain Henry E. M. Douglas, R.A.M.C., V.C., D.S.O.; Feargus Dwyer; Albert Edward*

Evans, R.N.R.; George William Poole Fisher; Thomas George Goodman; Lieut.-Colonel H. P. Gough, 16th Lancers; Arthur Hall Hall; James Meldrum; Major P. R. Phibbs (Dorset Regiment); Thomas George Seymour; Everard D. Simpson, B.A.; Captain W. M. Guthrie Smith, I.S.C.; Hugh Rose Troup; Rev. W. W. Tyler, B.D.; Thomas Herbert Worsnop.

The Paper read was :—

"A Buried Landscape in the English Midlands." By Prof. W. W. Watts.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. *Globus* **83** (1903): 21–28. **Halbfass.**
Beiträge zur Kenntnis der Seen der Lechthaler Alpen. Von W. Halbfass. *With Maps.*

Ardennes. *Deutsch. Rundschau G.* **25** (1902 1903): 102 110, 165–172, 212–220. **Kellen.**
Durch die Wälder der Ardennen. Von Tony Kellen. *With Illustrations.*

Austria—Moors. *Deutsch. Rundschau G.* **25** (1903) 193-207. **Bersch.**
Die Moorgebiete Österreichs. Von Dr. W. Bersch. *With Map and Illustrations.*

Belgium—Historical. **Huisman.**
La Belgique Commerciale sous l'Empereur Charles VI., la Compagnie d'Ostende. Étude historique de politique commerciale et coloniale. Par Michel Huisman Bruxelles: H. Lamertin, 1902. Size 9½ × 6½, pp. xii. and 556

Denmark. ——
Den Danske Turistforenings Aarsskrift, 1903. København; G. E. C. Gad, 1903 Size 9½ × 6, pp. 72 and xxxiv. *Map and Illustrations. Presented by Mr. E. L Salomonsen.*

Europe—Maps and Views. ——
Topographie de l'Europe. Catalogue à prix marqués de Cartes anciennes et de Vues de Villes, XV^me^-XIX^me^ siècle. Amsterdam: F. Muller & Cie., 1903 Size 9½ × 6½, pp. 240.

France—Corsica—Malaria. *Questions Dipl. et Colon.* **15** (1903): 157-166. **Guasco.**
Le paludisme et l'initiative privée en Corse. Par A. Guasco.

France—Glaciers. *C. Rd.* **136** (1903): 107-109. **Girardin.**
Sur des observations glaciaires faites en haute Maurienne dans l'été de 1902 Note de Paul Girardin.

France—Provence. *B.S.G. Marseille* **26** (1902): 260-272. **Barré.**
La répartition de la population sur le Sol de la Provence. Par H. Barré.

France—Rhone. *Ann. G.* **11** (1902): 407-418. **Douxami.**
La vallée moyenne du Rhône à travers le Jura méridional. Par H. Douxami.

France—Rochefort. *B.S.G. Rochefort* **24** (1902): 281-301. **Roche.**
Le Port de commerce de Rochefort. Par F. Roche. ***With Map and Plan.***

Germany. **Bludau.**
Oberland, Ermeland, Natangen und Barten. Eine Landes- und Volkskunde von Prof. Dr Alois Bludau Stuttgart: Hobbing & Büchle, 1901. Size $8\frac{1}{2} \times 6$, pp. xii. and 340. *Map and Illustrations. Price* 9 *m. Presented by the Publishers.*

Germany. **Volk.**
Der Odenwald und seine Nachbargebiete. Eine Landes- und Volkskunde. Unter Mitwirkung vieler Landeskenner herausgegeben von Georg Volk. Stuttgart: Hobbing & Büchle, 1900. Size $8\frac{1}{2} \times 6$, pp. 440. *Map and Illustrations. Price* 10 *m. Presented by the Publishers.*

Germany—Bavaria. **Hübler.**
Bayerisch Schwaben und Neuburg, und seine Nachbargebiete. Eine Landes- und Volkskunde von Dr J. M. Hübler. Stuttgart: Hobbing & Büchle, 1901 Size $8\frac{1}{2} \times 6$, pp. viii. and 326. *Map and Illustrations. Price* 7 *m. Presented by the Publishers.*

Germany—Bavaria. *Vierteljahrs. G. Unterricht* **2** (1903): 90-93. **Kollbach.**
Ein Ausflug in die Hohe Rhon. Von K. Kollbach.

Germany—Prussia—Westphalia. **Hellmann.**
Regenkarte der Provinz Westfalen sowie von Waldeck, Schaumburg-Lippe, Lippe-Detmold und dem Kreis Rinteln. Mit erläuterndem Text und Tabellen. In amtlichem Auftrage bearbeitet von Prof. Dr. G. Hellmann. Berlin: D. Reimer, 1903 Size $10\frac{1}{2} \times 7$, pp. 30. *Map.*

Germany—Rhine. *Meteorolog. Z.* **19** (1902): 548-551. **Stolberg.**
Verhalten der Rheintemperaturen in den Jahren 1895-1900. Von A. Stolberg.

Germany—Thuringia. *Z. Ges. Erdk. Berlin* (1902): 850-874 **Schlüter.**
Die Siedelungen im nordöstlichen Thüringen. Von Dr. Otto Schlüter.

Greece—Eubœa. *C. Rd.* **136** (1903): 105-107. **Deprat**
Note préliminaire sur la géologie de l'île d'Eubée. Note de M. Deprat.

Holland. *Tijds. K. Ned. Aard. Genoots. Amsterdam* **20** (1903): 1-34. **Bruijn**
De temperatuur van de oude raardsche gangen in den St. Pietersberg en andere mergelgroeven bij Maastricht Door Fred. de Bruijn, S.J. *With Maps.*
To be noticed in the Monthly Record.

Italy. **Baedeker.**
Italy Handbook for Travellers, by Karl Baedeker. Third Part: Southern Italy and Sicily, with Excursions to the Lipari Islands, Malta, Sardinia, Tunis, and Corfu. Fourteenth Revised Edition. Leipsic K. Baedeker, 1903. Size $6\frac{1}{2} \times 4$, pp. lii. and 441 *Maps and Plans. Price* 6 *m. Presented by the Editor.*

Italy. **Nissen.**
Italische Landeskunde. Von Heinrich Nissen. Zweiter Band. Die Staedte, Zweite Haelfte. Berlin: Weidmannsche Buchhandlung, 1902. Size 9×6, pp. 481-1001
Cf. *Journal.* vol. xx. p 351.

Italy—Emilia. *Rev. G. Italiana* **9** (1902): 437 445, 499-506, 565 581. **Lorenzi.**
Intorno ad alcune salse del Modenese, osservazioni del Dott Arrigo Lorenzi.

Mediterranean—Crete. *J.R.I. Brit. Architects* **10** (1902): 97-106. **Evans.**
A Bird's-eye View of the Minoan Palace of Knossos, Crete. By Dr. A. J. Evans. *With Plan and Illustration.*

Norway—Railways. *Globus* 82 (1902): 372–374. **Hoffmann**
Neue Norwegische Bahnen und ihre Bedeutung. Von Dr. B. Hoffmann.

Norway—Snow-limit. *Norske G. Selsk. Aarbog* 13 (1901–1902): 59–73. **Hansen**
Snegrænsen i Norge. Af dr. Andr. M. Hansen. *With Map and Diagram.*
See note in Monthly Record for March (p. 316).

Russia. **Bonmariage.**
La Russie d'Europe. Topographie, relief, géologie, hydrologie, climatology, régions naturelles, les peuples et leur mode de répartition. Essai d'Hygiène Générale. Par le Dr. A. Bonmariage. Paris: Le Soudier, 1903. Size 11 × 7½, pp. viii and 560. *Maps and Illustrations. Price* 20*s.*

Russia. *B.S.G. Lille* 38 (1902): 341–363. **Patouillet.**
L'Est de la Russie d'Europe. Par J. Patouillet.

Russia—Iron Industry. *J.S. Arts* 51 (1902): 74–91. **Head**
The South Russian Iron Industry. By Archibald P. Head. *With Maps and Illustrations.*

Russia—Ural. *C. Rd.* 135 (1902): 1135–1137. **Duparc.**
Sur l'origine de la coupure transversale de la Kosva (Oural du Nord). Note de Louis Duparc.

Spain—Historical. *B.S.G. Lisboa* 20 (1902): 67–84. **Garofalo**
Sulla geografia della Penisola Iberica nella età romana. Pelo Prof Francisco P Garofalo.

Sweden. ——
Exkursion nach Süd-Schweden (Schonen) am 20—24 Mai 1902. Greifswald, 1902. Size 9 × 6, pp. 16. *Maps.*

Sweden—Agriculture. *Ymer* 22 (1902): 305–360. **Högbom.**
Om norra Sverige såsom jordbruksland. Af A. G. Högbom. *With Map.*
See note, *ante*, p. 75.

Switzerland. **Rittener.**
Matériaux pour la Carte Géologique de la Suisse publiés par la Commission Géologique de la Société Helvétique des Sciences Naturelles aux frais de la Confédération. Nouvelle Série: XIII^e Livraison. Étude géologique de la Cote-aux-Fées et des environs de Ste-Croix et Baulmes. Par Th. Rittener. Berne: Schmid & Francke, 1902. Size 12½ × 9½, pp. vi., 116, and x. *Map and Profiles Price* 15 *fr. Presented by the Publisher.*

Switzerland. ——
Annuaire Statistique de la Suisse. Publié par le Bureau de Statistique du Département Fédéral de l'Intérieur Onzième Année, 1902. Bern: Stampfli & Cie., 1902. Size 10 × 6½, pp. 342. *Diagrams*

Switzerland—Geneva. *B G. Hist. et Descriptive* (1902): 276–281. **Fauvel.**
Le nouveau plan de la ville et de la commune de Genève. Par E. Fauvel.

Switzerland—Geographical Dictionary. **Knapp, Borel, and Attinger.**
Geographisches Lexikon der Schweiz mit dem Beistande der Geographischen Gesellschaft zu Neuenburg herausgegeben unter der Leitung von Charles Knapp, Maurice Borel, und V. Attinger, Deutsche Ausgabe besorgt von Heinrich Brunner. Erster Band. Aa Emmengruppe. Neuenburg: Gebrüder Attinger, 1902 Size 11 × 7½, pp. xii und 704. *Maps and Illustrations. Presented by Dr. H. Brunner.*

Contains a great deal of valuable matter, both geographical and statistical. The treatment of the morphology of the lakes is especially good.

United Kingdom. *Petermanns M.* 48 (1902): 230–234. **Koffmahn**
Eine neue Karte von Grossbritannien und Irland. Von Otto Koffmahn.

A detailed account of the method of preparation of the new map of the British Isles in Stieler's 'Hand-Atlas.' The author passes some strong criticisms on the Ordnance Survey maps, but his statements are in most cases quite unfounded (see *ante*, p. 448)

United Kingdom—Cornwall. *Geolog. Mag.* 10 (1903): 19–25. **Kennard and Warren**
The Blown Sands and Associated Deposits of Towan Head, near Newquay, Cornwall. By A. S. Kennard and S. H. Warren.

United Kingdom—Ireland. *P.R. Irish A.* **24**, Sec. B. (1902): 95–202. **O'Reilly**
On the Waste of the Coast of Ireland as a Factor in Irish History. By J. P. O'Reilly.

United Kingdom—Ireland—Botany. *P.R. Irish A.* **24**, Sec. B. (1902): 1–60. **Praeger.**
On Types of Distribution in the Irish Flora. By R. Lloyd Praeger. *With Diagrams.*
See abstract in January *Journal* (pp. 50–62, with maps).

United Kingdom—Ireland—Botany. *P.R. Irish A.* **24**, Sec. B. (1902): 61–94. **Praeger.**
Gleanings in Irish Topographical Botany. By R. L. Praeger.

United Kingdom—Scotland. *Scottish G. Mag.* **19** (1903): 27–37. **Macbean.**
Ancient Fife: seen through its Place-Names. By L. Macbean.

United Kingdom—Temperature. ———
Temperature Tables for the British Islands. Supplement. Difference Tables for each Five Years for the extrapolation of Mean Values. London: Eyre & Spottiswoode, 1902. Size 12½ × 10, pp. viii. and 36. *Price 3s. Presented by the Meteorological Office.*

ASIA.

Arabia. *B. Comité l'Asie Française* **3** (1903): 13–21. **Imbart de la Tour.**
Autour de l'Arabie. Par J. Imbart de la Tour.
On the present political position in Arabia.

Central Asia. *La G., B.S.G. Paris* **6** (1902): 69–74. **Hedin**
Mon dernier voyage en Asie centrale. Par Sven Hedin. *With Map.*

Central Asia. *B.S.G. Marseille* **26** (1902): 285–296. **Levat.**
Les résultats de l'expédition française scientifique et minière en Boukharie et au Turkestan, en 1909. Par E. D. Levat. *With Map.*

Ceylon—Botany. *J. Ceylon Br. R. Asiatic S.* **17** (1902): 89–256. **Lewis.**
A Descriptive Catalogue of the more useful Trees and Flowering Plants of the Western and Sabaragamuwa Provinces of Ceylon. By F. Lewis. *With Maps.*

China. *B.S.G. Rochefort* **24** (1902): 302–323. **Ballande.**
Six mois sur les rivières du Pé-Tchéli. Par C. Ballande.

Chinese Empire—Eastern Turkestan. *Petermanns M.* **48** (1902): 288–290. **Himly.**
Sven Hedins Ausgrabungen am alten Lop-nur. Von K. Himly.

Eastern Asia. *Petermanns M.* **48** (1902): 261 265. **Futterer.**
Prof. F. v. Richthofens Geomorphologische Studien aus Ostasien. Von Prof. Dr. K. Futterer.

Eastern Asia—Bibliography. **Barthold.**
Russische Arbeiten über Ostasien: Jahresbericht für 1901. Von W. Barthold. (Mittheilungen des Seminars für Orientalische Sprachen zu Berlin. Jahrg. V. Erste Abth. Ostasiatische Studien Pp. 155–162.) Berlin: G. Reimer, 1902. Size 10 × 7.

Eastern Asia—Treaties. **Reinach**
L. de Reinach. Recueil des Traités conclus par la France en Extrême-Orient (1684–1902). Paris: E. Leroux, 1902. Size 10 × 6½, pp. 142. *Price 15s.*

French Indo-China. **Pavie and Lefèvre-Pontalis.**
Mission Pavie Indo-Chine 1879–1895. Géographie et Voyages. V. Voyages dans le Haut Laos et sur les frontières de Chine et de Birmanie. Par Pierre Lefèvre-Pontalis. Introduction par Auguste Pavie. Paris: E. Leroux, 1902. Size 11 × 9, pp. xlviii. and 328. *Maps and Illustrations.*
This will be specially noticed.

French Indo-China—Cambodia. **Lajonquière.**
Inventaire descriptif des Monuments du Cambodge. Par E. Lunet de Lajonquière. Paris: E. Leroux, 1902. Size 11 × 7½, pp. cvi. and 430. *Illustrations.*

French Indo-China—Laos. *B.S.G. Com. Paris* **24** (1902): 273–287. **Audoüin.**
Quelques notes sur la province du Tran-Ninh (Laos) Par H. Audoüin. *With Map.*

French Indo-China—Tongking. **Girod.**
Miss. Catholiques **34** (1902): 472–475, 485–490, 497–500, 510–514, 526–528, 533–537
Une tournée dans la région située au N.-O. de Lao-Kay. Par M. Girod. *With Map and Illustrations.*

India. **Forrest.**
Cities of India. By G. W. Forrest. Westminster: A. Constable & Co., Ltd., 1903. Size 9 × 5½, pp. xvi. and 354. *Map and Illustrations. Price* 10s. 6d. *net. Presented by the Publishers.*

India. *Rev. G.* **51** (1902): 344–365, 422–446. **Malleterre.**
L'Empire anglais des Indes, Étude historique et politique. Par Commandant Malleterre.

India—Assam. **Oldham.**
On Tidal Periodicity in the Earthquakes of Assam. By R. D. Oldham. (Extract from the *Journal of the Asiatic Society of Bengal*, vol. lxxi. pp. 139–153, 1902.) Calcutta, 1902. Size 9½ × 6½. *Presented by the Author.*
This is noticed in the Monthly Record (*ante*, p. 451).

India—Burma. **Hertz.**
A Practical Handbook of the Kachin or Chingpau Language, containing the Grammatical Principles and Peculiarities of the Language, Colloquial Exercises, and a Vocabulary, with an Appendix on Kachin Customs, Laws, and Religion. By H. F. Hertz. Rangoon, 1902. Size 10¼ × 7, pp. v. and 164. *Price* 1s. 9d. *Presented by the Author.*

India—Census. **Bannerman.**
Census of India, 1901. Vol. xxv. Rajputana. Part i. Report, by Captain A. D. Bannerman (Lucknow, 1902, pp. iv. and 220). Vol. xxv.-A. Rajputana. Part ii. Imperial Tables, by Captain A. D. Bannerman (Lucknow, 1902, pp. 746). *Maps and Diagrams. Presented by the Indian Government.*

India—Census. **Lowis.**
Census of India, 1901. Vol. xiiA. Burma. Part ii. Imperial Tables. By C. C. Lowis. Rangoon, 1902. Size 13 × 8½, pp. 432. *Diagram. Presented by the Indian Government.*

India—Forests. *J.R. Colonial I.* **34** (1903): 173–191. **Gamble.**
The Forests of India and their Management. By J. S. Gamble.

India—Geological Survey. **Griesbach.**
General Report on the Work carried on by the Geological Survey of India for the period from April 1, 1901, to March 31, 1902. Under the direction of C. L. Griesbach. Calcutta, 1902. Size 10½ × 7½, pp. 36. *Presented by the Geological Survey of India.*

India—Historical. *B. l'Ecole Française d'Extrême-Orient* **2** (1902): 256–259. **Huber.**
L'Itinéraire du pélerin Ki Ye dans l'Inde. Par Edouard Huber.

India—Madras—Rainfall. *Monthly Weather Rev.* **30** (1902): 438–440. **Rao.**
The Rainfall in the City of Madras and the Frequency of Sun Spots. By M. B. Subha Rao. *With Diagram.*

India—Panjab. **Maclagan.**
Gazetteer of the Multan District. By E. D. Maclagan, 1901–02. Revised Edition Lahore, 1902. Size 9 × 6½, pp. ix. and 388 and lxx. *Map. Price* 5s. *Presented by the Secretary of State for India.*

India—Survey. ———
Synopsis of the Results of the Operations of the Great Trigonometrical Survey of India. Vol. xix. Descriptions and Co-ordinates of the Principal and Secondary Stations and other fixed points of the Great Arc—Section 8° to 18° or Series A of the Southern Trigon. Dehra Dun, 1899. Size 12½ × 10, pp. x., xiv., and 322. *Charts and Diagram.*

Japan. **Dumolard.**
Henry Dumolard. Le Japon politique, économique et social Paris: A. Colin, 1903. Size 7½ × 5, pp. viii. and 344. *Price* 4 *fr. Presented by the Publishers.*
See Review in March number (p. 305).

Japan. *Petermanns M.* **48** (1902): 245–253. **Yamasaki.**
Morphologische Betrachtung des japanischen Binnenmeers Setouchi. Von Dr. N. Yamasaki. *With Map.* (See note, *ante*, p. 453.)

Japan—Tobacco. **Lehmann**
M. Deutsch. Ges. Natur- u. Völkerk. Ostasiens **9** (1902): 57–78.
Der Tabak, sein Bau und seine Weitere Behandlung in Japan. Von Dr. Max Lehmann.

Korea. *B.S.G. Com. Paris* **24** (1902): 225–259. **De Lapeyrière.**
La Corée. Par M. De Lapeyrière.

Malay Archipelago—Celebes. *Globus* **83** (1903): 45–47. **Sarasin.**
Weitere Reisen der Herren Sarasin in Celébes. Von Palu nach Paloppo.

Malay Peninsula. *J.R. Colonial I.* **34** (1903): 75–105. **Clifford.**
British and Siamese Malaya. By Hugh Clifford, C.M.G.

North-East Asia. **Zabel.**
Durch die Mandschurei und Sibirien. Reisen und Studien von Rudolf Zabel. Leipzig: G. Wigand, 1902. Size 11 × 8, pp. xii. and 314. *Portrait and Illustrations. Price 20s.*

Persia. *J.S. Arts* **51** (1902): 95–105. **Sykes.**
Domestic Life in Persia. By Miss Ella C. Sykes.

Persia—Khorassan and Sistan. **Whyte and Benn.**
Trade of Khorassan and Sistan for the year 1901–02. Foreign Office, Annual No. 2921, 1902. Size 10 × 6½, pp. 44. *Price 2½d.*

Russia—Siberia. **Cooke.**
Trade of Siberia. Foreign Office, Miscellaneous No. 585, 1902. Size 10 × 6½, pp. 26. *Price 2d.*

Russia—Siberia. *Questions Dipl. et Colon.* **14** (1902): 746–760. **Labbé.**
La région du fleuve Amour: la province Maritime. Par Paul Labbé. *With Map.*

Russia—Siberia. *Petermanns M.* **48** (1902): 234. **Toll.**
Die Aufnahme der Taimyr-Bai 1900 01. Durch Baron E. Toll. *With Map.*

Russian Central Asia—Lake Aral. **Berg.**
Zur Morphologie der Ufern des Aral-Meeres. Von L. Berg. (Extrait de *Annuaire géologique et minéralogique de la Russie* (vol. v. Livr. 6–7), édité et rédigé par N. Krichtafowitsch). [In Russian.] Varsovie, 1902. Size 12½ × 9½, pp. 181–196. *Plates. Presented by the Author.*
This was noticed in the Monthly Record for March (p. 317).

Russian Central Asia—Lake Aral. *Petermanns M.* **48** (1902): 260–261. **Woeikow.**
Ueber den Aral-See. Von Prof. Dr. A. Woeikow.

Siam. *T'oung Pao* **3** (1902): 240 247. **Suzor.**
Le Laos Siamois. Par M. Suzor.

South-East Asia—Historical. **Gerini.**
Imp. and Asiatic Quarterly Rev. **11** (1901): 379–385; **13** (1902): 119–147, 361–368; **14** (1902): 391–407.
Siam's Intercourse with China. (Seventh to Nineteenth Centuries.) By Major G. E. Gerini.

Turkey -Arabia. **Forder.**
With the Arabs in Tent and Town. An Account of Missionary Work, Life and Experiences in Moab and Edom and the First Missionary Journey into Arabia from the north. By A. Forder. London: Marshall Brothers, 1902. Size 8 × 5, pp. xii. and 241. *Map and Illustrations.*
From a geographical point of view the interest centres in the journey to the Jof. which has already been described in the *Journal* (vol. xx. p. 619).

Turkey—Asia Minor. *Petermanns M., Ergänzungsheft Nr.* **140** (1902): pp. 90. **Fitzner.**
Niederschlag und Bewölkung in Kleinasien. Von Dr. Rudolf Fitzner. *With Map.*

Turkey—Palestine. **Hull.**
Palestine Exploration Fund, Quarterly Statement (1903): 92–98.
Notes on Prof. Libbey's Account of the Jordan Valley and Petra. By Prof. Hull.
The writer considers that Prof. Libbey's assumptions (in his paper read at Belfast) are "based on little or no evidence."

Western Asia—Bibliography. **Barthold.**
Russische Arbeiten über Westasien. Jahresbericht für 1901. Von W. Barthold (Mittheilungen des Seminars für Orientalische Sprachen zu Berlin. Jahrg. V. Zweite Abth. Westasiatische Studien. Pp. 25–47.) Berlin: G. Reimer, 1902. Size 10 × 7.

AFRICA.

Abyssinia. *Nineteenth Century* **53** (1903): 79–97. **Berkeley.**
The Abyssinian Question and its History. By G. F. H. Berkeley.

Abyssinia. *Questions Dipl. et Colon.* **15** (1903): 129–142. **Terrier.**
La délimitation de l'Ethiopie. Par A. Terrier. *With Map.*

Africa—Forests. **Breschin.**
La G., B.S.G. Paris **5** (1902): 431–450; **6** (1902): 27–39, 218–237
La forêt tropicale en Afrique principalement dans les Colonies françaises. Par A. Breschin. *With Maps.*

Africa—Minerals. **Launay.**
Les Richesses Minérales de l'Afrique. L'or, les metaux, le diamant, les phosphates, le sel, les combustibles, les sources thermales, etc. Algérie et Tunisie, Egypte, Abyssinie, Soudan, Côte d'Or, Transvaal, Rhodésia, Afrique Centrale, Madagascar, etc. Par L. de Launay. Paris: C. Béranger, 1903. Size 10 × 6, pp. 416. *Price* 16*s.* 9*d.* *Maps and Illustrations.*

Africa—Tsetse Fly. *Beiträge Kolonialpolitik* 4 (1902–1903): 263–271. **Lichtwardt.**
Ueber die Tsetse. Von B. Lichtwardt. *With Plate.*

Algeria. *Ann. G.* **11** (1902): 221–246, 339–365, 419–438. **Bernard and Ficheur.**
Les Régions naturelles de l'Algérie. Par Augustin Bernard et Émile Ficheur, accompagné d'une note cartographique par René de Flotte Roquevaire. *With Maps and Profiles.*

British East Africa—Uganda. **Austin.**
With Macdonald in Uganda. A Narrative Account of the Uganda Mutiny and Macdonald Expedition in the Uganda Protectorate and the Territories to the North. By Major Herbert H. Austin. London: E. Arnold, 1903. Size 9½ × 6, pp. xvi. and 314. *Map and Illustrations. Presented by the Publisher.*

British East Africa—Uganda. **Mahon.**
Exotic Plants of Economic Interest in the Botanic Gardens at Entebbe, Uganda. Foreign Office, Miscellaneous, No. 588, 1903. Size 9¾ × 6¼, pp. 8. *Price* ½*d.*

Egypt. **Beadnell.**
Survey Department, Public Works Ministry, Egypt. Geological Survey Report, 1900. Part ii. The Cretaceous Region of Abu Roash near the Pyramids of Giza. By Hugh J. L. Beadnell. Cairo: National Printing Department, 1902. Size 11 × 7½, pp. 48. *Maps and Plates.*

Egypt—Nile. *Z. Ges. Erdk. Berlin* (1902): 694–722, 753–762. **Blanckenhorn.**
Die Geschichte des Nil-Stroms in der Tertiär- und Quartärperiode, sowie des paläolithischen Menschen in Ägypten. Von Dr. Max Blanckenhorn. *With Maps*

Eritrea. *Rev. G. Italiana* **9** (1902): 537–564. **Loperfido**
Notizie sulla triangolazione dell' Eritrea. A. Loperfido. *With Diagram and Illustration.*

French Congo. *Meteorolog. Z.* **19** (1902): 509–512. **Hann**
Klima am oberen Schari im französischen Sudan. Von J. Hann

French West Africa. *La G., B.S.G. Paris* **7** (1903): 19–31 **Barot.**
L'Afrique occidentale française et ses conditions d'habitabilité. Par Dr. Barot. *With Maps.*

German East Africa. **Schmidt.**
Deutsch. Kolonialblatt **13** (1902): 335–336, 365–367, 411–413, 438–440, 463–465, 489–491, 519–520, 541–543.
Das Kameel als Transportmittel in Deutsch-Ostafrika. Von Thierarzt Schmidt

German East Africa. *Deutsch. Kolonialblatt* **13** (1902): 437–438. **Wendt**
Wami- und Mligazibereisung.
On an expedition to test the navigability of the Wami.

German South-West Africa. *M. Deutsch. Schutzgeb.* 15 (1902): 182–188. **Ambronn.**
Resultate der geographischen Ortsbestimmungen von Dr. G. Hartmann in Deutsch-Südwestafrika. Berechnet von Prof. Dr. Ambronn.

German South-West Africa. **Jodtka.**
Deutsch. Kolonialblatt 13 (1902): 493–495, 524–526, 546–548, 590–592.
Reise des Assistentarztes Jodtka nach dem Okavango. *With Map.*

German South-West Africa. *M. Deutsch. Schutzgeb.* 15 (1902): 181. **Schnauder.**
Ergebnisse der astronomischen Ortsbestimmungen in Deutsch-Südwestafrika von Oberleutnant Freiherrn v. Fritsch. Berechnet von Prof. Schnauder.

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Gold Coast. Report for 1901. Colonial Reports, Annual No. 375, 1902. Size 9½ × 6, pp. 36. *Price* 2½*d.*

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Ueber Ortsnamen in Kamerun. Von E. Dinkelacker.

Kamerun. *Deutsch. Kolonialblatt* 13 (1902): 543–546, 588–590. **Pavel.**
Oberst Pavel über seine Expedition nach dem Tsadsee.

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Bericht des Oberleutnants Frhrn. v. Stein über die Bertua-Expedition.

Madagascar. *Rev. Madagascar* 4 (1902): 549–553. **Imbert.**
Impressions de voyage, au pays de l'Androy ou brousse épineuse. Par Lieutenant E. Imbert. *With Illustrations.*

Madagascar—Majunga. *Rev. Madagascar* 4 (1902): 521–548. **Moriceau.**
Le Nord de la province de Majunga. Par L. Moriceau. *With Illustrations.*

Madagascar—Railway. *Rev. Madagascar* 4 (1902): 481–513. ——
Une date dans l'histoire économique de Madagascar. Inauguration du premier tronçon du chemin de fer de la côte orientale à Tananarive. *With Illustrations.*

Morocco. **Doutté**
Renseignements Colon., Comité l'Afrique Française, No. 8 (1902): 157–164.
Troisième voyage d'études au Maroc, rapport sommaire d'ensemble de Edmond Doutté. *With Map.*

Morocco. *M.G. Ges. Jena* 20 (1902): 1–105. **Pfeil.**
Geographische Beobachtungen in Marokko. Von Joachim Grafen von Pfeil.

Morocco. *La G., B.S.G. Paris* 7 (1903): 82–87. **Roquevaire.**
Voyages au Maroc du Marquis de Segonzac. Par René de Flotte Roquevaire. *With Map.*

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Mission du capitaine Lenfant, commandant la flottille du bas Niger. *With Map.*

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Trade of the Province of St. Thomé and Principe. Foreign Office, Annual No. 2922, 1902. Size 10 × 6, pp. 24. *Price* 1½*d.*

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Sur les terrains paléozoïques de l'Oued Saoura et du Gourara. Note de E. F. Gautier.

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Trente jours au Mouydir. Par le lieutenant E. Réquin. *With Map.*
Noticed in the Monthly Record for March (p. 322).

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Sahara: Le raid du lieutenant Cottenest. Par C. R. *With Map.*

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South Africa and its Future, edited by Louis Creswicke. Contributors:—The Duke of Argyll, K.T., Hon. A. Wilmot, E. F. Knight, etc. London & Edinburgh: T. C. & E. C. Jack, 1903. Size 10 × 6½, pp. 200. *Maps and Illustrations. Price* 7*s.* 6*d. net. Presented by the Publishers.*

South Africa—Surveys. *M. Deutsch. Schutzgeb.* 15 (1902): 250–260. **Görgens.**
Das Landvermessungs- und Fortschreibungs-System der Kapkolonie und seine modifizirte Anwendung in Deutsch-Südwestafrika. Nach einem Bericht von Regierungslandmesser H. Görgens.

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La zone frontière Loango-Cabinda, d'après les travaux de la Commission franco-portugaise de délimitation. Par M. Chesneau. *With Map.*

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Affairs of West Africa. By Edmund D. Morel. London: W. Heinemann, 1902. Size 9 × 5½, pp. xv. and 382. *Maps and Illustrations. Price* 12*s.*

West Africa—Cotton Cultivation. *J. African S.* 2 (1902): 1–10. **Helm.**
The cultivation of cotton in West Africa. By Elijah Helm.

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Alaska—Mt. McKinley. *National G. Mag.* 14 (1903): 30–35. **Brooks and Reaburn.**
Plan for Climbing Mt. McKinley. By A. H. Brooks and D. L. Reaburn. *With Map.*

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The Canadian West and North-West. By W. A. Hickman.

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The Geological History of the Gaspereau Valley, Nova Scotia. By Prof. E. Haycock. *With Section.*

Canada—Nova Scotia. *T. Nova Scotian I. Sci.* 10 (1900–1901): 379–398. **Mackay.**
Phenological Observations of the Botanical Club of Canada, 1900; Abstract of Phenological Observations on Flowering of ten Plants in Nova Scotia, 1900, with Remarks on their Phenochrons. By Dr. A. H. Mackay. *With Diagrams.*

North and Central America. **Ridgway.**
B. United States Nat. Museum 50 (1902): pp. xx. and 834.
The Birds of North and Middle America. By R. Ridgway. Part ii. *With Plates.*

United States. ——
Annual Reports of the Department of the Interior for the Fiscal Year ended June 30, 1900. Report of the Commissioner of Education. 2 vols. Pp. lxxx. and 2648.

Ditto, June 30, 1901. Indian Affairs. Parts i. and ii., pp. (Part i.) x. and 806; (Part ii.) 894. Miscellaneous Reports. Parts i. and ii., pp. (Part i.) 744; (Part ii.) 722. Washington, 1901–1902. Size 9½ × 6½. *Maps and Illustrations. Presented by U.S. Department of the Interior.*

As usual, these reports, profusely illustrated by maps and photographs, constitute a mine of information on the geography and statistics of various parts of the United States, including Alaski, Hawaii, and Porto Rico. There are some striking representations of the crater of Mauna Loa and its lava-flows, views of Skagway and its wharf, statistics of irrigation in Arizona, reports on the Yosemite, Sequoia and General Grant National Parks (as well as the Yellowstone), with illustrations of the giant trees, and other items too numerous to mention.

United States—Climate. *Monthly Weather Rev.* 30 (1902): 440–442. **Wilson**
Indian Summer. By W. M. Wilson.

Quotes statistics showing that conditions popularly regarded as characteristic of Indian summer are quite as common in other seasons (cf. *Journal*, vol. xx., p. 458).

United States—Colorado River. **Dellenbaugh.**
The Romance of the Colorado River. The Story of its Discovery in 1540, with an Account of the Later Explorations, and with Special Reference to the Voyages of Powell through the Line of the Great Canyons. By Frederick S. Dellenbaugh. New York and London: G. P. Putnam's Sons, 1902. Size 9 × 6, pp. xxxv. and 400. *With Maps and Illustrations. Price* 15*s. net.*

The writer was a member of the Expedition of 1871–72.

United States—Ohio. *National G. Mag.* 13 (1902): 398–403. **Mosely.**
Submerged Valleys in Sandusky Bay. By Prof. E. L. Mosely. *With Charts.*

United States—Trade. **Hitchcock**
Sources of the Agricultural Imports of the United States, 1897–1901. By Frank H. Hitchcock. Pp. 132. Distribution of the Agricultural Exports of the United States, 1897–1901. By the same. Pp. 292. (U.S. Department of Agriculture Section of Foreign Markets—Bulletins Nos. 28 and 29.) Washington, 1902. Size 9 × 6. *Presented by the U.S. Department of Agriculture.*

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Argentine Republic. *An. Museo Nac. Buenos Aires* **8** (1902): 1–12. **Ameghino.**
Cuadro sinóptico de las formaciones sedimentarias, terciarias y cretáceas de la Argentina en relación con el desarrollo y descendencia de los mamíferos. Por F. Ameghino.

Bolivia and Argentine. *Ymer* **22** (1902): 437–464. **Nordenskiöld**
Resa i gränstrakterna mellan Bolivia och Argentina Af E. Nordenskiöld. *With Illustrations.*

Brazil—Ceará. *Meteorolog. Z.* **19** (1902): 552–559. **Draenert.**
Zum Klima des Staates Ceará, Brasilien. Von Prof F M Draenert.

Brazil—Rio Grande do Sul. **Meinhold.**
Beiträge Kolonialpolitik **4** (1902–1903): 284–297.
Bauerliches Leben in São Lourenço (Rio Grande do Sul). Von Hauptmann F. Meinhold.

British Guiana. **King.**
British Guiana. Report for 1901–1902. Colonial Reports, Annual No. 378, 1903 Size 10 × 6½, pp. 38. *Price 2½d.*

Chile. *La G., B.S.G. Paris* **6** (1902): 142–149. **Albert.**
Les plantations des dunes de Chauco (Chili). Par Dr F. Albert

Colombia—Puracé Volcano. *Scottish G. Mag.* **19** (1903): 57–65. **White.**
Ascent of an Andean Volcano in Eruption. By R. B. White. *With Illustrations.*
The ascent was of the Puracé Volcano near Popayan, and was made in 1868.

Paraguay. *Rev. Française* **27** (1902): 505–515, 576–589, 709–717. **Mouchez**
Une excursion au Paraguay avec le naturaliste Bomplan (1857) Par Contre-Amiral Mouchez.

Peru. *B.S.G. Lima* **12** (1902): 125–155. **Carvajal.**
Rectificación de las coordenadas geográficas de algunos puntos de la via Central Por el Contralmirante M. Melitón Carvajal *Also separate copy, presented by the Author.*

Peru.
Immigrant's Guide to Peru (the Central Railway and the Zone of the Pichis). Lima, 1902. English Translation issued by the Peruvian Legation in London. Size 8 × 5½, pp. 58. *Maps and Illustrations*

Peru. ———
Reseña industrial del Perú Lima, 1902 Size 10 × 7, pp. 52. *Illustrations.*

Peru—Mantaro. *B.S.G. Lima* **12** (1902): 161–184 **Ráez.**
El Mantaro y sus afluentes. Por Nemesio A. Ráez.

Peru—Railway. *B.S.G. Lima* **12** (1902): 184–194. **Scold**
Ferrocarril al Marañón Por el ingeniero Sam. M. Scold

South America—River Communication. *B.S.G. Lima* **12** (1902): 195–204. **Maúrtua.**
Communicación de las hoyas hidrográficas sud-Americanas Por el Dr Victor M. Maúrtua.

South Georgia. *Ymer* **22** (1902). 409–421. **Andersson**
Antarctics vinterexpedition till Syd-Georgien. Rapport från Svenska sydpolar-expeditionen. Af J. G. Andersson. *With Illustrations.*
Cf. *Journal*, vol xx. p. 405.

West Indies—Historical. *B.G. Hist. et Descriptive* (1902): 207–252. **Saint-Yves.**
Les premières relations des Antilles françaises et des Antilles anglaises. Por G Saint-Yves.

West Indies—Martinique. **Heilprin.**
Mont Pelée and the Tragedy of Martinique. A Study of the great Catastrophes of 1902, with Observations and Experiences in the Field, by Angelo Heilprin. Philadelphia and London: J. B. Lippincott & Co., 1903. Size 9½ × 6, pp. xiii. and 336. *Maps and Illustrations. Price* 15*s. net. Presented by the Publishers.* [To be reviewed.]

West Indies—Martinique and St. Vincent. **Russell.**
National G. Mag. 13 (1902). 415–436.
Volcanic Eruptions on Martinique and St. Vincent. By Prof. Israel C. Russell. *With Illustrations.*

West Indies—St. Vincent. *National G. Mag.* 13 (1902): 444–459. **Hovey.**
The Eruptions of La Soufrière, St. Vincent, in May, 1902. By E. O. Hovey. *With Illustrations.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australia. *P.R.G.S. Australasia, S. Australian Br.* 5 (1902): 29–31. **Winnecke.**
Davidson's West Central Australia Exploration. By C. Winnecke.

Australia—Flinders Centenary. ———
P.R.G.S. Australasia, S. Australian Br. 5 (1902): 45–68.
The Flinders Centenary.

New Guinea—Dutch. **Koning.**
Bijd. Taal-, Land- en Volkenk. Ned.-Indië 1 (1903): 250–280.
Eenige gegevens omtrent land en volk der Noord-Oostkust van Ned Nieuw-Guinea, genaamd Papoea Telandjang, ontleend aan het rapport van D. A. P. Koning. *With Map and Plates.*

New Guinea—German. *Petermanns M.* 48 (1902): 278–286. **Danneil.**
Zwei wenig bekannte Inseln östlich von St. Matthias im Bismarck-Archipel. Von Dr. C. Danneil. *With Maps.*

Samoa. *M.G. Ges. Jena* 19 (1901): 1–52. **Kurze.**
Die Samoaner in der heidnischen Zeit. Von G. Kurze.

Solomon Islands. *Norske G. Selsk. Aarbog* 13 (1901-1902): 23–58. **Nerdrum.**
Indtryk og oplevelser under et 7 aars ophold paa Salomonøerne af J. G. B Nerdrum. *With Map and Illustrations.*

Solomon Islands. **Woodford.**
British Solomon Islands. Report for 1901-1902. Colonial Reports, Annual No. 372, 1902. Size 9½ × 6, pp. 22. *Price* 1½*d.*

South Australia. **Murray and Maurice.**
P.R.G.S. Australasia, S. Australian Br. 5 (1902): 33–42.
Mr. R. T. Maurice's Expedition North of Fowler's Bay.
See note in *Journal*, vol. xix. p. 760.

Western Australia. *Z. Ges. Erdk. Berlin* (1902): 797–813. **Diels.**
Reisen in West-Australien. Von Dr. Ludwig Diels. *With Illustrations.*

Western Australia. ———
Western Australia. Report of the Department of Mines for the year 1901 [with which is incorporated the Preliminary Report]. Perth, 1902. Size 13½ × 8½, pp. 110 and 106. *Maps and Illustrations. Presented by the Department of Mines, Perth, Western Australia.*

Western Australia—Minerals. **Simpson.**
Western Australia. Geological Survey. Bulletin No. 6, Notes from the Departmental Laboratory. By Edward S. Simpson. Perth, 1902. Size 8½ × 5½, pp. 90. *Illustrations.*
Miscellaneous information on the minerals of Western Australia.

POLAR REGIONS.

Antarctic. *Ann. G.* 11 (1902): 385–406. **Zimmermann**
Terres, climats et glaciers antarctiques. Par M. Zimmermann.

Arctic—Peary Expedition. *National G. Mag.* **14** (1903): 29. **Peary.**
Peary on the North Pole.

Arctic—Russian Expedition. *Ymer* **22** (1902): 422–424. **Toll.**
Den ryska polarexpeditionens arbeten under år 1901. Af Edv. v. Toll.

Arctic—Sverdrup's Expedition. *Petermanns M.* **48** (1902): 269. **Isachsen.**
Kurze Uebersicht über die Arbeiten der zweiten norwegischen Polarfahrt (*Fram*, Kapitän O. Sverdrup). Mitgeteilt von Rittmeister Gunnar Isachsen. *With Map.*

Arctic—Sverdrup's Expedition. *Ymer* **22** (1902): 529–534. **Nathorst.**
Sverdrup's polar expedition 1898–1902. Af A. G. Nathorst. *With Map.*

Arctic—Sverdrup's Expedition. *La G., B.S.G. Paris* **6** (1902): 243–248. **Rabot**
L'Expédition du Capitaine Otto Sverdrup dans l'Archipel polaire américain. Par C. Rabot.

Arctic Ocean. **Vilkitski.**
Meteorological and Hydrographical observations made in the summer of 1901 by the expedition to the Northern Glacial Ocean under command of Polkovnik Vilkitski. [In Russian.] St. Petersburg, 1902. Size 11 × 8½, pp. iv. and 77.

Greenland. *La G., B.S.G. Paris* **6** (1902): 79–100. **Rabot.**
Les récentes explorations danoises à la côte orientale du Grönland. Par C. Rabot. *With Maps and Illustrations.*

Résumé of papers in the *Meddelelser om Grønland.*

Greenland. *Meddelelser om Grønland* **27** (1902): 1–107. **Amdrup.**
Beretning om Expeditionen til Grønlands østkyst 1898–99 af G. Amdrup. *With Illustrations.*

Greenland. *Meddelelser om Grønland* **27** (1902): 341–352. **Amdrup.**
Hydrografi fra Skibsexpeditionen til Grønlands Østkyst 1900. Af G. Amdrup.

Greenland. *Meddelelser om Grønland* **27** (1902): 153–181. **Hartz.**
Beretning om Skibsexpeditionen til Grønlands Østkyst. For Tidsrummet fra d. 18. Juli til d. 12. September 1900. Af N. Hartz.

See also *Journal*, vol. xx. p. 129.

Greenland. *Meddelelser om Grønland* **27** (1902): 273–303. **Koch.**
Bemærkninger vedrørende de paa Skibsexpeditionen til Grønlands Østkyst 1900 opmaalte Kyststrækninger mellem 69° 20′ N. Br. og 72° 20′ N. Br. Af J. P. Koch. *With Illustrations.*

Greenland. *Meddelelser om Grønland* **25** (1902): 13–42. **Meldorf.**
Fra en Vaccinationsrejse i Egnen omkring Kap Farvel i Efteraaret 1900. Af Gustav Meldorf. (*Résumé* in French, pp. 246–250.)

Greenland. *Meddelelser om Grønland* **27** (1902): 305–340. ———
Résumé af de astronomiske, meteorologiske og magnetiske Observationer samt Nordlysiakttagelser foretagne paa den østgrønlandske Expedition 1898–99.

Greenland—Disco Island. *Meddelelser om Grønland* **25** (1902): 91–239. **Porsild.**
Bidrag til en Skildring af Vegetationen paa Øen Disko tilligemed spredte topografiske og zoologiske Iakttagelser. Af M. P. Porsild. (*Résumé* in French, pp. 251–307.) *With Illustrations.*

Greenland—Zoology. *Meddelelser om Grønland* **21** (1902): 317–521. **Winge.**
Grønlands Pattedyr. Af Herluf Winge. *With Map.*

MATHEMATICAL GEOGRAPHY.

Cartography. **Torbert.**
Maps and Map Making. By John B. Torbert. Reprinted from *Bulletin* of the American Geographical Society, June, 1902. Size 10 × 6½, pp. 14. *Illustrations.*

Determination of Position. **Güssfeldt.**
Grundzüge der Astronomisch-Geographischen Ortsbestimmung auf Forschungsreisen und die Entwickelung der hierfür massgebenden Mathematisch-Geometrischen Begriffe. Von Prof. Dr. Paul Güssfeldt. Braunschweig: F. Vieweg & Son, 1903. Size 9 × 6, pp. xx. and 378. *Diagrams. Price 10m. Presented by the Publishers.*

Surveying Instruments. **Bakhuis.**
Tijds. K. Ned. Aard. Genoots. Amsterdam **20** (1903): 76–86.
De Hodograaf en de Pedograaf van Th. Ferguson. Door L. A. Bakhuis.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geological Formations. *J. Geology* **10** (1902): 691–699. **Keyes.**
Cartographic Representation of Geological Formations. By C. R. Keyes.

Geology—Laterite. *Geolog. Mag.* **10** (1903): 59–69. **Holland.**
On the Constitution, Origin, and Dehydration of Laterite. By T. H. Holland.

Geology—Sedimentary Deposits. *Geolog. Mag.* **10** (1903): 12–18, 72–80. **Blake.**
On the Original Form of Sedimentary Deposits. By the Rev J. F. Blake. *With Map and Diagrams.*

Geology—Soils. *C. Rd.* **135** (1902): 1353–1355. **André.**
Sur la nature des composés azotés qui existent dans le sol à différentes hauteurs. Note de G. André.

Glaciers. **Rabot.**
Essai de Chronologie des Variations Glaciaires. Par C. Rabot. (Extrait du *Bulletin de Géographie historique et descriptive*, No. 2, 1902.) Paris: Imp. Nationale, 1902. Size 10 × 6½, pp. 48. *Presented by the Author.*

Meteorology—Bibliography. ———
International Catalogue of Scientific Literature. First Annual Issue. F. Meteorology, including Terrestrial Magnetism. London: Harrison & Sons, 1902. Size 8½ × 5½, pp. xiv. and 184. *Price* 15*s.*

In the subject-catalogue the regional subdivision is subordinated to that into the various branches of meteorology, so that the entries relating to any one country are widely scattered. From a geographical point of view this may be thought a drawback, though possibly it best meets the requirements of meteorologists.

Meteorology—Hail Prevention. ———
Jahrb. K.K. Central-Anstalt Meteorolog. u. Erdmagnetismus **39** (1902), *Anhang* pp. 151.
Bericht über die Internationale Experten-Conferenz für Wetterschiessen in Graz.

Meteorology—Pressure. *P.R.S.* **71** (1902): 134–135. **Lockyer.**
On the Similarity of the Short-period Pressure Variation over Large Areas. By Sir Norman Lockyer, K.C.B., etc., and Dr. W. J. S. Lockyer. *With Diagrams.* [See also *Nature* **67** (1903): 221–226.]

Oceanography. *Z. Ges. Erdk. Berlin* (1902): 763–796. **Meinardus.**
Die oceanologischen Ergebnisse der Valdivia-Expedition. (Nach der Bearbeitung von Dr. Gerh. Schott.) Von Dr. Wilh. Meinardus.

Oceanography. *Petermanns M.* **48** (1902): 217–223, 268. **Schott.**
Die Verteilung des Salzgehalts im Oberflächenwasser der Ozeane. Von Dr. G. Schott. *With Map.*

Oceanography—Atlantic. *La G., B.S.G. Paris* **7** (1903): 1–18. **Bénard.**
Les courants de l'Atlantique Nord et du golfe de Gascogne. Par C. Bénard. *With Maps. Also separate copy, presented by the Author.*

Soils. *Scottish G. Mag.* **19** (1903): 20–27. **Hardy.**
Humus as a Geographical Agency. By Marcel Hardy.

Terrestrial Physics. ———
The National Physical Laboratory. Report for the year 1901. London: Harrison & Sons, 1902. Size 11 × 7½, pp. 54.

Contains reports on magnetic, meteorological, and seismological observations at Kew and elsewhere.

Volcanoes. **Anderson.**
Volcanic Studies in Many Lands, being reproductions of photographs, by the Author, of above one hundred actual objects, with explanatory notices. By Tempest Anderson. London: J. Murray, 1903. Size 10½ × 7½, pp. xxviii. and 202. *Plates. Price* 21*s. net. Presented by the Publisher.*

This is not a systematic treatise on volcanic phenomena, but a series of typical illustrations with descriptions.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Historical—Springer. **Schulze.**

Balthasar Springers Indienfahrt 1505/6. Wissenschaftliche Würdigung der Reiseberichte Springers zur Einführung in den Neudruck seiner "Meerfahrt" vom Jahre 1509 von Franz Schulze. Strassburg: Heitz & Mundel, 1902. Size 8½ × 5½, pp. 100. *Facsimiles. Price 6s.*

See Review in March number, p. 315.

Historical—Teixeira. **Sinclair and Ferguson.**

The Travels of Pedro Teixeira; with his 'Kings of Harmuz,' and extracts from his 'Kings of Persia.' Translated and Annotated by William F. Sinclair. With further Notes and an Introduction by Donald Ferguson. London: Hakluyt Society, 1902. Size 9 × 5½, pp. cviii. and 292. *Presented by the Hakluyt Society.*

GENERAL.

Education—Military. ——

Report of the Committee appointed to consider the Education and Training of Officers of the Army, together with Appendix. London: Eyre & Spottiswoode, 1902. Size 13½ × 8½, pp. 150. *Price 1s. 3d.*

Encyclopædia. **Meyer.**

Meyers Grosses Konversations-Lexikon. Ein Nachschlagewerk des allgemeinen Wissens. Sechste, günzlich neubearbeitete und vermehrte Auflage. Erster Band. A bis Astigmatismus. Leipzig u. Wien. Bibliographisches Institut, 1902. Size 10 × 6½, pp. viii. and 904. *Maps, Plates, and Illustrations. Price 9s.*

French Colonies. **Mourey and Brunel.**

L'Année Coloniale publiée sous la direction de Ch. Mourey et Louis Brunel. Troisième Année (1901). Paris: Société de l'Annuaire Colonial, 1902. Size 9 × 6, pp. 330. *Illustrations. Presented by the Publishers.*

This useful publication now appears for the third time, and the present issue, like its predecessors, supplies an excellent summary of the progress of the French Colonies during the year.

Geography. **Ratzel.**

Die Erde und das Leben. Eine vergleichende Erdkunde von Prof. Dr. Friedrich Ratzel. Zweiter Band. Leipzig und Wien: Bibliographisches Institut, 1902. Size 10½ × 7, pp. xii. and 702. *Maps, Plates, and Illustrations. Presented by the Publishers.*

Germans. **Langhans.**

Deutsche Erde. Beiträge zur Kenntnis deutschen Volkstums allerorten und allerzeiten. Herausgegeben von Prof. Paul Langhans. I. Jahrgang, 1902. Gotha: J. Perthes. Size 10½ × 7½, pp x and 182. *Maps. Price 6m.*

The first year's issue of a new serial devoted to the study of the Germans throughout the world. The separate articles, mostly dealing with the distribution of Germans in foreign countries, are amply illustrated by maps, both in the text and separate.

Hindustani Language. **Thimm.**

Hindustani Grammar Self-taught. In four parts. I. A Simplified Grammar. II. Exercises and Examination Papers. III. The Vernacular. IV. Key and Dictionary. By C. A. Thimm. London: E. Marlborough & Co., 1902. Size 7 × 4½, pp 118. *Price 2s. 6d. Presented by the Publisher.*

As in so many works of the kind, grammatical usages are too often treated as stereotyped facts, without any clear explanation of their *raison d'être*. Confusion of ideas is also sometimes shown, as when *kitne*, "how many?" is put down as an adverb.

Hints to Travellers. **Reynolds-Ball.**

Practical Hints for Travellers in the Near East. A companion to the Guide Books. By E A. Reynolds-Ball. London: E. Marlborough & Co, 1903. Size 7½ × 5, pp. 140 *Illustrations. Price 2s. 6d. Presented by the Publisher.*

These hints give practical information on just the points on which it is most needed by tourists.

Mountaineering. **Le Blond.**

True Tales of Mountain Adventure for Non-climbers, Young and Old. By Mrs.

Aubrey Le Blond (Mrs. Main). London: T. Fisher Unwin, 1903. Size 9 × 5½, pp. xviii. and 300. *Illustrations. Price* 10*s.* 6*d. net. Presented by the Publisher.*

The author, herself an enthusiastic mountaineer, has in this work made a judicious selection, from published works, of some of the most stirring episodes in the history of mountain-climbing, and adds some interesting items from her own experiences. There are four chapters on mountaineering in general, glaciers, etc., written for the benefit of the uninitiated.

Mountains. **Grand-Carteret.**

John Grand-Carteret. La Montagne à travers les Ages. Rôle joué par elle: Façon dont elle a été vue. I. Des temps antiques à la fin du dix-huitième siècle. Grenoble: H. F. Falque & F. Perrin, 1903. Size 11½ × 9, pp. xvi. and 560. *Illustrations. Price* 33*s.* 6*d.*

NEW MAPS.

By E. A. REEVES, *Map Curator,* **R.G.S.**

EUROPE.

Balkan Peninsula. **Cvijic.**

T. Cvijic. Die grossen Seen der Balkan-Halbinsel. 10 Karten. Belgrade: Der Akademie der Wissenschaften, 1902. *Presented by the Academy of Sciences, Belgrade.*

There will be a special notice of this portfolio of maps in a future number of the *Geographical Journal.*

Central Europe. **Liebenow and Ravenstein.**

Liebenow-Ravenstein's Special-Radfahrerkarte von Mittel-Europa. Scale 1 : 300,000 or 4·7 stat. miles to an inch. Sheets—6, Memel; 7, Schawli; 8, Tilsit; 9, Kowno; 10, Tondern; 11, Sonderburg; 15, Stolpmünde; 16, Hela; 17, Königsberg; 18, Insterburg u. Gumbinnen; 19, Suwalki; 20, Tönning; 21, Kiel; 22, Rostock; 23, Stralsund; 24, Colberg; 25, Köslin; 26, Danzig; 27, Elbing; 28, Lötzen; 29, Augustowo; 30, Terschelling; 31, Emden; 32, Wilhelmshaven; 33, Hamburg; 34, Schwerin; 35, Anklam; 36, Stettin; 37, Tempelburg; 38, Bromberg; 39, Deutsch Eylau; 40, Neidenburg; 41, Bialystok; 43, Groningen; 44, Bremen; 45, Lüneburg; 46, Wittenberge; 47, Ruppin; 48, Küstrin; 49, Kreuz; 50, Gnesen; 51, Plock; 53, Siedlee; 56, Zwolle; 57, Minden; 58, Hannover; 59, Magdeburg; 60, Berlin; 61, Frankfurt; 62, Posen; 63, Kalisch; 66, Lublin; 70, Wesel; 71, Arnsberg; 72, Cassel-Göttingen; 73, Halle; 74, Leipzig; 75, Cottbus; 76, Liegnitz; 77, Breslau; 80, Sandomierz; 84, Köln; 85, Marburg-Wetzlar; 86 Eisenach; 87, Erfurt; 88, Chemnitz; 89, Dresden; 90, Hirschberg; 91, Neisse; 92, Bouthen; 98, Prüm; 99, Frankfurt a. M.; 100, Kissingen; 101, Bamberg; 102, Eger; 112, Frier; 113, Mannheim; 114, Würzburg; 126, Nancy; 127, Strassburg. Frankfurt a. M.: Ludwig Ravenstein.

England and Wales. **Ordnance Survey.**

Ordnance Survey of England and Wales:—Revised sheets published by the Director-General of the Ordnance Survey, Southampton, from February 1 to 28, 1903.

1 inch:—

With hills in brown or black: 76, 77, 105, 119, 127, 150 (engraved). 1*s. each.*

Printed in colours: 120, 142, 163, 165. 1*s. each.*

6-inch—County Maps:—

Bedfordshire, 13 S.E., 19 N.W. **Cambridgeshire,** 44 S.E., 45 S.E. **Dorset,** 22 N.W., N.E., 31 N.W., S.W., 39 S.W., S.E., 47 S.W., S.E. **Huntingdonshire,** 27 S.E., 28 S.E. **Montgomeryshire,** 5 N.W., 16 S.W., 23 N.W., N.E., 24 N.W., 26 S.W., S.E., 27 N.E., S.E., 29 S.W., 38 S.W. **Shropshire,** 6 N.E., 14 S.E., 17 N.W., 21 N.E., 31 S.W., 32 S.W., 33 S.E., 36 N.E., 39 N.W., 41 N.W., 42 S.W., S.E., 44 S.E. **Staffordshire,** 22 N.E., 35 N.E., 51 N.W., 52 N.W., S.E., 56 N.W., 57 N.W., N.E., S.W., 58 N.W., N.E., S.E. **Warwickshire,** 4*a* S.E.

25-inch—County Maps:—

Cambridgeshire, XIII. 13; XVII. 5; XXIII. 11; XXVII. 3; XXXVI. 3, 7, 8, 11, 12, 16; XLII. 3, 4, 7, 8, 11, 12, 15, 16; XLVII. 14; LIII. 15; LIV. 1, 6, 10,

13; LV. 4. 16; LVII. 3, 4, 7, 8, 11, 12; LVIII. 4, 8; LIX. 1, 2, 6. **Dorsetshire**, VI. 1, 7, 9, 10, 11, 12, 14, 15, 16; XI. 4, 8, 14; XII. 1, 2, 3, 4, 5, 6, 8; XXI. 4; XXIX. 12; LVIII. (2 and 1) 11. **Gloucestershire**, XVII. 13; XXII. 8, 12; XXVI. 6; XXVII. 5, 6, 15; XXXIV. 9, 13; XXXVI. 10, 12, XLI. 1, 2, 9; XLII. 2, 5, 8, 9, 10, 14, 15; XLIII. 1, 2, 4, 5, 6, 10, 14, 15, 16; XLIV. 13, 14; XLV. 5, 13; XLIX. 9; L. 3, 8, 9, 10, 11, 14, 15, 16; LI. 3, 7, 8; LII. 2, 6, 10, 11, 13, 14; LIII. 1, 9; LV. 1, 2, 8; LVI. 1; LVIII. 2, 3, 4, 6, 9, 13; LIX. 4, 7, 8, 9, 14; LX. 1, 5, 6, 9; LXI. 2, 3, 6; LXVI. 5, 9; LXVIII. 12; LXX. 6; LXXIII. 4, 5, 8; LXXIV. 1; LXXVIII. 5, 9. **Leicestershire**, V. 6; IX. 4, 12, 15; X. 5, 10; XVI. 3, 6; XVII. 13; XXII. 8. **Montgomeryshire**, XXXVII. 16; XXXVIII. 9, 11; XLIII. 4, 16; XLIV. 4, 5, 7, 9, 14; XLV. 1, 8; XLVIII. 8, 16; XLIX. 6. **Radnorshire**, I. 16; III. 8, 16; IV. 6; VIII. 1, 5. **Shropshire**, XLVII. 11; LIV. 9, 11; LVII. 14, 15, 16; LVIII. 8; LIX. 14, 15, 16; LXI. 4, 7, 12, 14, 16; LXII. 1, 3, 4, 5, 6, 7, 8, 11, 15, 16; LXIII. 7, 12; LXIV. 5; LXV. 2, 3, 4, 6, 7, 8, 10, 12; LXVI. 9; LXVII. 2, 3, 6, 7, 10, 11, 12, 16; LXVIII. 3; LXX. 2; LXXI. 1. **Somersetshire**, VII. 15; VIII. 9, 10, 13 LXXXIV. 1, 2, 3, 4, 7, 10, 11, 12, 14, 15; LXXXVII. 1, 2, 6, 8; XC. 14. **Staffordshire**, XLII. (4 and 8); XLIII. 1, 5, 9, 13; XLIX. 2, 5, 6, 7, 9, 12; LV. 4; LXII. 14, 16; LXIII. 9, 10; LXV. 10; LXVII. 1, 2, 6; LXX. 3, 7, 15; LXXIV. 2. **Suffolk**, XLII. 3 (areas of Exning parish only); XLII. 7 (areas of Exning parish only). **Warwickshire**, III. 9; V. 10. **Worcestershire**, III. 15; VIII. 2, 9, 13; XIV. 13, 15, 16; XV. 13, 14, 15, 16; XXI. 2, 3, 6, 7, 10, 11; XXII. 3, 5, 6, 9, 12. **Worcestershire** (Det. No. 6), LXII. 3 **Worcestershire** (Det. No. 7), LXII. 12. **Yorkshire**, CCLXXXIII. 8; CCLXXXIV. 2, 12; CCLXXXVI. 1; CCLXXXIX. 4; CCXCV. 4, 8, 16.

1-inch—Miscellaneous Maps:—

Petty Sessional Divisions in colour:—London, County of. 6*d.*

England and Wales. **Geological Survey.**

Maps (1-inch). New Series (colour-printed). Sheet 298 (Salisbury), Drift Edition. 1*s.* 6*d.* (with explanations).

MEMOIRS:—

Index to Report on the Geology of Cornwall, Devon, and West Somerset. 1*s.*
Isle of Man. Geology of the. 12*s.*
Salisbury, Geology of the Country around (Explanation of Sheet 298). 1*s.* 3*d.*

(*E. Stanford, London Agent.*)

England and Wales. **Bartholomew.**

The Survey Atlas of England and Wales. A series of eighty-four plates of maps and plans, with Descriptive Text, illustrating the Topography, Physiography, Geology, Climate, and the Political and Commercial Features of the Country. Designed by and prepared under the direction of J. G. Bartholomew, F.R.S.E., F.R.G.S. Part 2. Edinburgh: John Bartholomew & Co. Under the Patronage of the Royal Geographical Society, 1903. *Price* 2*s.* 6*d. each part. Presented by the Publishers.*

A notice of this atlas appeared in the *Geographical Journal* for February last. The present part, No 2, contains the following maps: 10, Ecclesiastical and Parliamentary Maps; 27, Section xvi., Liverpool and Denbigh; 70, Section lix., Dorset and Portland. 71, Section lx., Southampton and Isle of Wight.

Norway. **Norges Geografiske Opmaaling**

Topografisk kart over kongeriget Norge. Scale 1 : 100,000 or 1·5 stat. miles to an inch. Sheets: 3-D, Egersund; 5-A, Kristiansand; 14-D, Kristiania; 32-B, Trysil; 32-D, Engerdalen; 55-B, Fraaholmen; 48-D, Tarbuskjær; G-19, Sklinden; H-18, Vega; H-19, Helgelandsflesa; H og I 12, Röst; I 10, Moskenesöen; I 19, Bindalen; J 9, Kvalnes; J 10, Vestvaagö; J 14, Melö; J 15, Svartisen; J 19, Börgefjeld; K 10, Svolvær; K 15, Dunderlandsdalen. 1900–1901.—*Price kr.* 0.60. Generalkart over det sydlige Norge. Scale 1 : 400,000 or 6·3 stat. miles to an inch. Sheets: XII., XIV., XVII. 1901.—*Price kr.* 0.60. Kart over Söndre Trondhjems Amt. Scale 1 : 200,000 or 3·1 stat. miles to an inch. Sheet I. 1901. *Price kr.* 1.00.—Specialkart over den Norske Kyst fra Ure til Brettesnes. Scale 1 : 50,000 or 0·78 stat. mile to an inch. 1902. *Price kr.* 1.00.—Specialkart over Havne i Finmarken. Scale 1 : 50,000 or 0·78 stat. mile to an inch. Bladd I. and II. 1901–1902. *Price kr.* 1.00. Christiania: Norges Geografiske Opmaaling. *Presented by l'Institut Géographique de Norvège.*

ASIA.

China. **Königl. Preuss. Landes-Aufnahme.**

Karte von Ost-China. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Kartographische Abtheilung der Königl. Preuss. Landes-Aufnahme, 1902. Sheets: "Futschau," "Hsi ngan fu," "Nan tschang fu," "Yi tschang fu," "Yü lin fu"

AFRICA.

Africa. **Intelligence Division, War Office.**

Africa. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Egyptian Sudan. Sheets: (Provisional) 46-M, Maman; (Provisional) 55-A, El Safia; (Provisional) 55-F, Ma'atuk; (Provisional) 55-G, Wad Medani. London: Intelligence Division, War Office; Stanford. 1902. *Price* 1s. 6*d*. *each sheet. Presented by the Director-General of Mobilization and Military Intelligence.*

Africa. **Friedrich.**

Produkten- und Verkehrskarte von Afrika. Bearbeitet von Dr. Ernst Friedrich. Scale 1 : 10,000,000 or 157·8 stat. miles to an inch. 3 Blätter, nebst einer Beigabe, Literaturverzeichnis und Statistik enthaltend. Bielefeld und Leipzig: Velhagen & Klasing, 1903. *Price* 9*m*.

A general map of Africa in three sheets, showing, by means of different colours, symbols, and lettering, the distribution of various minerals, and agricultural and animal products that have a commercial importance, as well as trade routes, steamer and telegraph lines, railways, anchorages, coaling stations, and other information of a similar character. Ten pages of letterpress accompany the map, giving the exports and imports of the various estates for the years 1899 and 1900. A list of the authorities consulted in the compilation of the map is also given. The map contains a vast amount of useful information, but it is so crowded with symbols that it is difficult to read.

German South-West Africa. **Nobiling.**

Wirtschafts- und Verkehrskarte von Deutsch-Südwestafrika. Scale 1 : 2,000,000 or 31·5 stat. miles to an inch. Gezeichnet von H. Nobiling. Berlin: Dietrich Reimer (Ernst Vohsen), 1903. *Presented by the Publisher.*

West Africa. **Meunier.**

Carte de la Guinée Française. Dressée par A. Meunier. Scale 1 : 500,000 or 7·8 stat. miles to an inch. 4 sheets. Ministère des Colonies. Service Géographique et des Missions. M. Camille Guy, Chef du Service. Paris: H. Barrère, [1903].

This map includes the area between 8° and 13° N. lat., and between 7° 40′ and 15° 40′ W. long. It has been compiled from the route surveys of many explorers, the names of forty-three being mentioned, and from the British and French Admiralty Charts. It is printed in colours, routes being in red and water blue. A full explanation of the symbols employed is given.

AMERICA.

Canada. **Surveyor-General's Office, Ottawa.**

Sectional Map of Canada. Scale 1 : 190,080 or 3 stat. miles to an inch. Souris Sheet (33), West of Second Meridian; revised to January 9, 1903: Yorkton Sheet (36), West of Second Meridian; revised to August 7, 1902: Prince Albert North Sheet (47), West of Second Meridian; revised to November 7, 1902: the Elbow Sheet (52), West of Third Meridian; revised to December 10, 1902. Ottawa: Surveyor-General's Office. *Presented by the Surveyor-General of Canada.*

Nova Scotia. **Government of Nova Scotia.**

Map of Nova Scotia. Scale 1 : 506,880 or 8 stat. miles to an inch. Published by order of the Government of Nova Scotia. Halifax, N.S.: A. & W. Mackinlay; London: G. Philip & Son. 1902. *Presented by the High Commissioner for Canada.*

A good general map of Nova Scotia, printed in colours and showing, in addition to topographical features, counties, railways, roads, and the location of minerals. Tables of the area and population of the different counties, and of the estimated value of products of Nova Scotia for the year 1901, are also given. The map includes Prince Edward island and the adjacent portion of New Brunswick.

CHARTS.

North Atlantic Ocean and Mediterranean Sea. **Meteorological Office, London.**

Pilot Chart of the North Atlantic and Mediterranean for March, 1903. London: Meteorological Office. *Price 6d. Presented by the Meteorological Office, London.*

United States Charts. **United States Hydrographic Office**

Pilot Chart of the North Atlantic Ocean for February, and of the North Pacific Ocean for March, 1903. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Central Asia. **Bruce.**

Forty-two Photographs of Central Asia, taken by Major C. D. Bruce in 1901 and 1902. *Presented by Major C. D. Bruce.*

One of Major Bruce's journeys, during which these photographs were taken, extended from Pekin to Russia, across the desert of Gobi, and another through northern Persia and along the line of the Transcaspian railway. The following are the titles :—

(1) Mounted Mongols dragging Major Bruce's Chinese cart with baggage; (2) Mongolian prayer-wheel; (3) One of Major Bruce's mounts in a Mongol camp with his own saddle; (4) Major Bruce's Chinese cart, taken from Kalgan to Urga for baggage; (5) Crossing the Selenga river between Kiachta and Verchni-Udinsk on a native ferry; (6) The "Living God" of Urga holding a wrestling fête; (7) Major Bruce's tarantan; (8) Mounted Mongols in the desert dragging Major Bruce's Chinese cart; (9) Mounted Mongols near the Kalgan border; (10) Mongol encampment of Arun-Naima in the middle of the desert; (14) A "turn" in the Russo-Persian road over the mountains from Askhabad to Meshed; (15) One of the main gates of Meshed; (16) Stone-cut inscription on a rock between Meshed and Kelat-i-Nadiri; (17) The Argwan Shah gate of Kelat-i-Nadiri; (18) The village of Nhowkhadar in the centre of the Deregez valley; (19) Among the ruins at Bairam-Ali; (20) The tomb of Sultan Sanjur; (21) Bokhara main city gate, native city; (22) Tank in the native city, Bokhara; (23) Some of the Emir's troops; (24) A colonel of the Emir's troops; (25) A street in Samarkand; (26) The court of the Tilah Hari, Samarkand; (27) Separate tombs outside and near the Shah Zindah; (28) Bibi Khanim's tomb, Samarkand; (29) A corner in the horse market, Samarkand; (30) A view of Samarkand. (31) The finest pair, but one, of *Ovis Ammon* horns Major Bruce saw on his journey; (32) A Central Asian common cart, an "arba;" (33) Group of Kirghiz near Aulieta; (34) The interior of a private stud farm; (35) Three Russian officers going on plague duty; (36 and 37) The Russian Archbishop of Turkestan arriving at a post station. Bernuel; (38) A Kirghiz on a cow; (39) Easter week at Kopal: a swing on the "village green;" (40) On the banks of the river Ayaguz, close to Sergiopol; (41) Major Bruce's companion, Captain Chirkarsoff, in a boat; (42) Kirghiz swimming the river; (43) Ferry over the Irtish river at Semipalatinsk; (44) Crossing by the ferry over the Irtish river; (45) A salt-heap near Pavlodar on the Irtish river.

West Indies. **Anderson.**

Eleven Photographs of Martinique and St. Vincent, taken after the eruptions of May, 1902, by Dr. Tempest Anderson. *Presented by Dr. Tempest Anderson.*

These photographs illustrate Dr. Tempest Anderson's paper in the *Geographical Journal* for last month.

(1) Tropical vegetation, Chateau Belair; (2) The Wallibu district from the sea; (3) In the Wallibu valley; (4) Steam and ash explosions, Wallibu; (5) The mouth of the Wallibu from the sea; (6) The site of the Wallibu subsidence; (7) A beach outside the devastated area; (8) Ridges on the Soufrière; (9) Main street of St. Pierre; (10 and 11) Mont Pelée in eruption.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

The
Geographical Journal.

No. 5. MAY, 1903. Vol. XXI.

FURTHER EXPLORATION IN THE CANADIAN ROCKY MOUNTAINS.*

By J. NORMAN COLLIE, F.R.S.

The exploration of the main range of the Canadian Rocky mountains lying between the sources of the Athabasca river and the Kicking Horse pass has been the subject of two papers read by myself before the Royal Geographical Society. In these two papers I attempted to give a description of some of the great snowfields that exist amongst the Rocky mountains, and also as far as possible to make clear the geography of a mountain district up till that time but little known.

Of course, during the short visits that I was able to make, many points of interest could not be answered, for panoramic views obtained from the tops of the snow-peaks were often interfered with, either by other peaks, cloudy weather, or sometimes smoke-haze. It must also be remembered that the country mapped, as the result of these visits, comprises about 3000 square miles; therefore it is not to be wondered at that there were a very considerable number of valleys whose sources were difficult to trace, glaciers and snowfields the direction of whose flow was problematical, and lastly, the altitudes of some of the highest peaks were doubtful. It was to solve many of these uncertainties that last summer I again returned to the Rocky mountains. I wished to discover, (1) what system of valleys lay on the south-west side of the Freshfield range; (2) to traverse the great Lyell snowfield, upon whose ice probably no human foot had yet trod, in order to learn about the complicated series of snow-peaks in that district; (3) to find out how the continental divide ran, and how also the various creeks of the Bush river were connected with the Lyell snowfield; lastly, I had a suspicion

* Read at the Royal Geographical Society, February 23, 1903. Map, p. 588.

that there ought to be an easy pass across the watershed between Mount Forbes and the Freshfield group of mountains. A new pass in this particular spot would be of much interest, for from the knowledge gained in former expeditions there did not seem, except at this spot, to be a possibility of any other undiscovered low pass existing from Fortress Lake pass on the Athabasca to the Kicking Horse pass on the railway line. Moreover, should the pass exist, it would be useful as a means of reaching the headwaters of the south fork of the Bush valley without the terribly hard work of forcing a way from the Columbia river on the west through the dense forests of the Bush valley up to the main range. These forests in 1900 had effectually stopped our expedition to the Columbia group of mountains, and we were forced to return without having reached even the head of the Bush valley. These, therefore, were some of the more important questions that I hoped to be able to answer before I returned to England last autumn.

The members of our party were four—H. E. M. Stutfield, H. Woolley, G. M. Weed (of Boston), and myself. Charles S. Thompson, of Dallas, Texas, one of the most enthusiastic climbers and explorers of these Canadian Rocky mountains, was also to have joined us, but just before starting from Laggan he was unfortunately recalled to Dallas by a telegram informing him that a large portion of the town had been destroyed by fire, including his home; he had therefore perforce to leave the cool breezes and beautiful scenery of the wooded valleys of the Rockies and return to the blazing heat of a Texan summer. In every expedition that I had made before in the Rockies our provisions had been a source of trouble to us; usually at the end of three weeks or so they had begun to give out. This time I was determined that we should not suffer as we had done formerly. I therefore asked our head man, Fred Stephens, who supplied us with horses and food, to start in at least three weeks before us with about 1000 lbs. of necessaries —flour, bacon, condensed milk, etc.—to take them as far as Bear Creek on the Saskatchewan, and there make a "cache." He was then to return with the horses and meet us at Laggan. This would not only enable us to bring in extra food with us, but the trail as far as the Saskatchewan would be cut—no inconsiderable gain, for the Bear Creek "cache" was at least 60 to 70 miles from the railway.

On July 24 we started from Laggan. Besides ourselves there was a Swiss guide, Hans Kaufmann, whom we had engaged from the Canadian Pacific Railway Co., whilst Fred Stephens had brought with him three men, J. Robson to cook, Clarence Murray to help with the horses, and Dave Tewksbury, a mighty axeman from the lumber camps of Wisconsin. Our journey up the Bow valley was without incident, if one excepts the usually harassing time spent in fighting with the mosquitoes and "bull-dogs," which latter this summer were in countless thousands. These "bull-dogs," or rather horseflies, were chiefly a

nuisance to the horses, preventing them from feeding properly, but they did not annoy us much.

It was not till the 28th that we reached the Saskatchewan at Bear Creek mouth. Here, the horses needing a rest, an off day was spent in visiting Mount Murchison, chiefly with the object of seeing again some curious fossil remains that I had discovered in 1898. Finding ourselves, however, on a wrong ridge, we decided instead to climb to the summit of it in order to obtain more knowledge of the group of peaks that constitute Mount Murchison. The ridge seemed endless, but at last, after climbing up some steep snow-slopes and along a narrow arête, we emerged on to the top, which, to our surprise, was the top of Murchison itself.

FRED STEPHENS.

This unexpected result was of considerable value from a topographical point of view, for I was able to see stretched out before me several minor valleys amongst the hills whose existence I was till then quite unaware of. The height of Murchison had been estimated by Dr. Hector to be about 13,500 feet, and he mentions that the Indians said that it was the highest mountain they knew of. Later in another map its height is given as 15,789 feet. A Watkin barometer, kindly lent me by the Geographical Society, made it only 11,100 feet, and as this aneroid agreed during the whole journey with a mercurial barometer I had with me, I take its number as correct.

Geologically, Murchison is most interesting. Not only had I found the curious fossil remains on it in 1898, but it, together with Wilson,

a little further north, constitute the two sides of a gigantic gateway to the hills through which the Saskatchewan turns to the east. The dip of the limestone strata on both these mountains differs in a marked manner from most of the neighbouring peaks, being towards the east. As a result, there are tremendous precipices on the wrong side of the mountain, namely, the western side. In almost every other mountain it is the eastern side that is sheer, with sloping shoulders towards the west and south-west.

Leaving Bear Creek the next day, we made our way up the middle fork of the Saskatchewan along the level bottom of the valley, our goal being the Freshfield group of mountains. On the 31st, in wet weather, we finally camped on the same spot where five years before Baker and I had pitched our tents. This spot was at the head of the "washout" where the glacial waters from the Freshfield snowfields meet those that came down from Forbes. The Rev. J. Outram, who had been mountaineering further north, now joined us, with a Swiss guide, C. Kaufmann, in order to attempt with us the ascent of Forbes and Freshfield. It was not, however, till the 2nd that we were able to get the horses with our camp outfit up to the foot of the Freshfield glacier, and not till the 4th that the weather would allow of the ascent being made. Our party was a big one, but as there were two Swiss guides we were able to split it into two, each party being led by one of the Kaufmanns. Just as with Baker and Sarbach five years previously, we started in the early hours of the morning. The glacier seemed to be exactly the same as we had left it, with the sole exception of a series of huge blocks of rock that had moved slightly down the glacier. Robson accompanied us to the head of the glacier, but it was with some misgiving when we parted company that I saw him start back to the camp alone, for there were so many deep crevasses that still held at their mouths the unmelted snow of the winter, and which were dangerous to any one who might be unaware of the insecure nature of such snow-bridges. However, on our return in the evening, we found that he had returned safely from this his first glacier expedition. Following the same route as Sarbach had taken Baker and myself, we rapidly climbed upwards, and I was naturally anxious that the day should remain fine, for once at the top of Freshfield, I should be able to see that part of the country which lay beyond on the western side, and which on my map was blank; also the complicated geography of the south branch of the Bush valley would be capable of being followed for the first time, and lastly, the question whether a low pass existed between the Lyell and Freshfield systems of ice-fields could be answered. Long before we arrived on the final arête of Freshfield this last question was settled, and it was with much satisfaction, as we mounted higher and higher, that I could follow how the valley that lay on the south side of Forbes took a bend to the south-west, joining a similar depression running north-east from the southern

fork of the Bush valley. The pass therefore existed, as I had always hoped it would, ever since when in 1897 I had penetrated into this lonely mountain land with Baker and Sarbach.

Towards the top of the mountain several difficult faces of rock and thin rocky edges had to be surmounted, but H. Kaufmann, who was leading, never seemed to be in any way anxious about our final success; ultimately we reached the summit, 10,900 feet, which consisted of snow, and was like most of the summits we ascended, heavily corniced with snow. The weather was perfect, and at our feet lay the unknown country, every valley plain; glaciers and streams sparkled in the sunshine, and, as I had more or less imagined from glimpses through the murky

BUSH PASS AND FRESHFIELD GROUP.

atmosphere of the Bush valley in 1900, directly to the west was the glacier which fed the south fork of the Bush river. To the north were all our old friends of 1898—Columbia, and Athabasca peak, Alberta, with the Twins straight in front, appearing to be part of it, the Dome, Lyell, Saskatchewan, and many more, to the west the Bush peak and the far-off Selkirk range beyond the Columbia river. Nearer to us on the south lay Pilkington, Walker, and Mummery. There is a great pleasure in standing on a high mountain in a country but imperfectly known, so many uncertainties vanish in a moment, often with the remark, "I thought so," whilst masses of new possibilities and further queries take their place. One of these queries which could not be answered was the height of a splendid pyramid of snow gleaming far away in the Selkirks. This peak we had seen day after day in 1900 from the Bush valley, now from a still greater distance it seemed even greater in

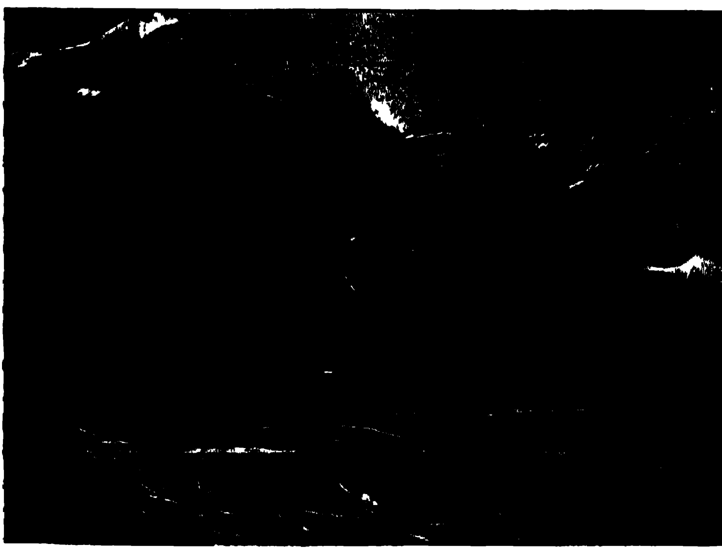
height, but what that may be must still remain unanswered. On the next day we returned to the "washout," near where the streams from Forbes and Freshfield meet.

In order to get our camp moved up to the foot of Forbes, it was necessary to cut a trail through the woods, and whilst this was being done we spent a delightful summer's day climbing on to the alp that lies on the east and north-east of Forbes. This alp is the largest that I know of south of Wilcox pass. In the early summer it must be carpeted with flowers, and even in August there were many still left in bloom, whilst the remains of numberless others could still be seen. This spot also seemed to be a favourite haunt of the mountain goat, for on emerging from the woods below on to the almost flat upper pasturage, large numbers of goats could be seen grazing in small groups, and over fifty head were counted. Soon, however, having caught sight of us, they moved off towards the precipitous faces of the hills that overlook the Saskatchewan on the east. That this country is much frequented by goat was again noticed just below Glacier lake, where, a log-jam having occurred across the river, forming a natural bridge, a large and newly worn goat-track was found leading down to this bridge on both sides of the river. Even in Dr. Hector's time (1858) this spot seems to have been a favourite crossing-place, for he mentions that, "while halting here a big-horn sheep came down the mountain almost close to us, but, seeing us first, made off without our getting a shot. Nimrod," an Indian hunter who accompanied him, "says this is the only place where these are to be seen so far in the mountains. A little way further through the woods brought us to a large lake, which occupied the full width of the valley." He then goes on to relate how his Indian ponies behaved in exactly the same manner as ours had often done; to again quote, "As we were chopping our way along, the same horse that played that frolic once before again plunged into the water and swam off into the lake. We had to leave him alone, lest our endeavours to get hold of him should only start him for the other shore of the lake, which was a mile wide."

To return, however, to the alp. Weed and I, after climbing to the upper and north side of the alp, ascended a small peak, from which there was a splendid view in every direction except to the north. The pass leading over to the Bush valley, which I have named the Bush pass, was plainly visible, and I was in hopes that it might prove feasible for horses; I visited it a few days later. A somewhat short but steep snow-slope on the eastern side proved that pack-horses could probably not be taken across.

It was not till the 8th that we moved our camp up the valley, camping in a small clear space that had been denuded of trees many years ago by a huge avalanche that had fallen from the south side of the valley, and, after crossing the stream, had swept away the forest

for perhaps 100 yards up the opposite face. From this camp, on the 9th, we started with blankets and food for a bivouac as high up Forbes as possible. Ultimately we camped directly under the peak, just at the limit of the tree-line, but not more than 1400 feet above our camp down below. During the night, although at the camp below the temperature was below freezing-point, yet amidst the great fir trees on the mountain-side where we bivouacked the air was quite warm. This may perhaps be due to the dense forest being much heated during the day-time by the sun, then, owing to the tendency of hot air to rise, a slow but continuous current of air filtered up the mountain-side amidst the trees, so keeping us warm nearly the whole night. Early next morning, almost in



MORAINE LAKE, DESOLATION VALLEY

the dark, we started for the ascent of Forbes. The day was perfect; only a faint but cold breeze blew. Soon we got to the small glacier under the peak; then, keeping to our left, struck the southern ridge. Here some difficult rock-climbing was met with, but C. Kaufmann led us rapidly upwards towards the snow-covered shoulder. Above the shoulder was perhaps the most difficult part of the climb, for there the arête became excessively steep, and in more places than one the rock was very insecure, being torn and shattered by the frost, making great care necessary. This part surmounted, a snow climb led us to the summit, 12,000 feet, which, like the summit of Freshfield, consisted of a huge snow-cornice.

At the suggestion of C. Kaufmann, who had seen the north-west

face of Forbes about ten days before, we did not return by the same route, but descended the snow-covered north-western side. Here we fortunately found the snow frozen hard, for the face was much too steep to walk down. For over 1500 feet Kaufmann had to cut every step; but at last we reached a small col, which was the connecting link between the massif of Forbes and the mountains on the west. Rapidly we glissaded from this col to the glacier below; then, skirting underneath the great southern precipices of Forbes, we came to the foot of the southern ridge, up which we had climbed in the morning, and just as the sun was setting we got back to our bivouac, too late, however, to think of returning to the camp below that night. But we had enough food to last us; so, lighting a fire, we talked over the climb, and then slept comfortably for the second time under the pine trees in the open air.

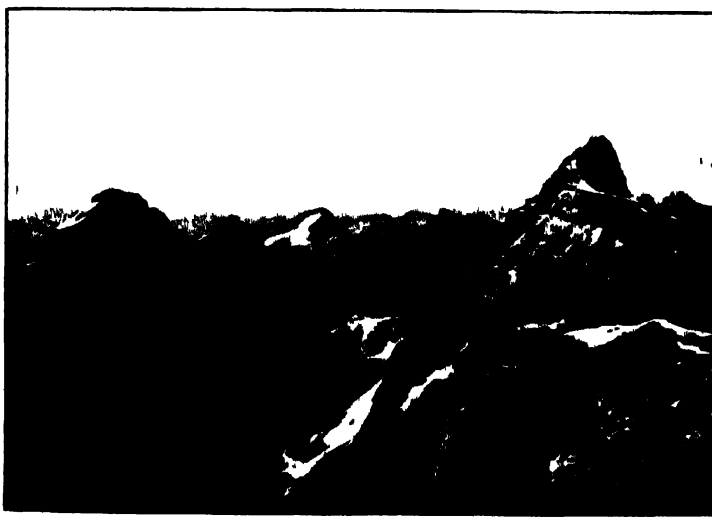
Next day, in company with Weed and Rev. J. Outram, I went up the valley to the Bush pass. To take horses there would mean an immense amount of cutting for the first few miles; after that, however, the valley opens up. But, as I have already said, even were horses brought as far as the foot of the pass, it is very doubtful whether they could be got up the steep snow-slopes which have to be surmounted before the summit is reached. On the west side there seems to be no difficulty and no snow, the valley stretching in a south-westerly direction till it joins the south branch of the Bush valley, which runs at right angles.

On the summit of the pass all the rocks are heavily glaciated, and at one time a huge glacier must have poured over it, whether in a northerly or southerly direction it is impossible to say. The height by the aneroid barometer was 7600 feet. We then returned to our camp, where we found that Fred Stephens, as we had not returned the night before, had become very anxious, and had ideas about organizing a search-party.

The ascent of Forbes was of much value to me, for whilst in the Bush valley I had never been able to see what lay between Forbes and the Bush peak; of course, from Forbes that part of the country lay at my feet, also the whole of the great Lyell snowfield, also how the west branch of the north fork of the Saskatchewan bent round up to the Columbia ice-field and to Mount Bryce—all this I could see. But we were all disappointed in the height of the mountain. Although a few days previously I had, by means of a base-line, a Steward's surveying telemeter, and a clinometer, made it to be about 12,250 feet (the mean of two observations), yet we hoped that it would prove to be considerably higher. By the aneroid, however, it was only 12,000 feet. It is true that the only times that I had seen Forbes from any high altitude and entirely free from clouds were from Freshfield with Baker in 1897, and from Athabasca peak with Woolley in 1898, but in the latter case the smoke haze almost obliterated it, making it loom out in a mysterious

and exaggerated way. Owing to the same cause we had also rather overestimated the heights of Columbia and Alberta. Whilst we were on the summit of Forbes, the only peaks that seemed higher were those to the north round the Columbia ice-field. Lyell was lower, and of course all the peaks to the south.

After our return from the Bush pass, on August 12 the Rev. J. Outram left us, in order to return to the west branch of the north fork of the Saskatchewan. We took our camp down the valley, and, turning southwards towards the Howse pass, camped underneath the Howse peak, which we climbed on the 14th. This peak, by aneroid barometer, is apparently about the same height as Freshfield, being 10,800 feet, and



MOUNTS BIDDLE AND HUNGABEE.

is a remarkable instance of a peak that has an easy side towards the west, while its eastern face is formed of a series of impossible precipices facing Bear creek and the Waterfowl lakes. From the Howse peak a good view of the Freshfield group was obtained, and I have named a fine peak on the eastern side of the Freshfield snowfield after Sir Martin Conway. Leaving the Howse peak behind, we next made our way towards the Lyell ice-field. Camping near the foot of Glacier lake, it was our intention to cut a trail up the side of the lake, but this was frustrated by our finding the woods on the northern side of the lake on fire. Fires in the dense pine woods of the Canadian Rockies are excessively dangerous to be near, and had it not been for a considerable stretch of hillside between us and the fire that had been cleared by avalanches, it would have been most foolish to go anywhere within miles of these burning woods

A gale may suddenly spring up, and before one has time to escape through the dense forest to safety, one's camp, one's horses, and one's self may all be involved in a common ruin. That a fire should have swept through this particular piece of country is very much to be regretted, for it will be at least a century before the ravages can be repaired, and, in the mean time for many years to come, the scenery of one of the most beautiful lakes in the Rocky mountains has been sadly marred. There it lies with one shore blackened and shorn of its beautiful primeval forest; whilst the charred trunks of the great pines and the poor stunted undergrowth will remain for years to come as a mute protest against the carelessness of those who do not see that their camp fires are properly extinguished.

As it was out of the question to attempt to cut a trail along the side of the lake, our only alternative lay in sailing up on a raft. For a whole day Fred and Dave toiled with the axes, and we could hear the ceaseless chopping down to the water's edge. Then the weather turned wet, and the fire up the valley was nearly extinguished. Fishing in the deep pools of the river that runs out of Glacier lake was indulged in, and with a piece of twine 6 feet long, a pole of the same length, and a hook baited with some bacon fat, I caught a bull trout about 5 lbs. in weight.

On the 19th the weather cleared. With much luggage we embarked on the raft, and slowly made our way along the shore to the upper end of the lake, where we camped, our horses in the mean time being left near the old camp, on some good feeding-ground up the mountain-side.

From this spot we started for the Lyell ice-field, bivouacking at the foot of the glacier. The next day saw us start for the upper snows. We kept to the east of the Lyell glacier, and followed very possibly the direction taken by Dr. Hector in 1858, when he climbed Mount Sullivan. To climb straight up the Lyell glacier on to the icefield above would be both foolish and dangerous, for the ice from above descends in a huge cascade from the higher levels over a wall of rock, and in most places would be quite impossible to climb up from below. By ascending a lateral valley to the right this was avoided, and we ultimately reached the great plateau of snow which is one of the sources of the Saskatchewan.

Before this, however, we scrambled to the summit of a rock peak that overlooks a valley running due east towards Mount Wilson. This valley is full of small lakes, and at its head is Mount Lyell. Once on the great snowfield, we slowly trudged onwards. This day was warm enough to melt the upper crust of the snow, making progress rather tedious, and the summit of Lyell that we had thought of climbing became covered with cloud whilst we were still over a mile away. The question whether we should climb in mist to the summit of the mountain, or instead strike across to a small eminence near the centre

of the glacier, was soon settled—I am afraid, much to Hans Kaufmann's disgust. All he could say was, "Not climb Lyell! You will regret it very much." I think that Woolley, too, who ought to have known better, heartily agreed with Hans, thinking that we were far too lazy a party to go out with, when serious mountaineering was the object. Be that as it may, personally, I was glad that the plans were changed, for, once on our small peak in the centre of the snowfield, I could see the Bush peak well, and the valleys round it; also other peaks to the north of the Bush peak, on the western side of which we had been in 1900. Moreover, I could follow how the ridge, of which Lyell is a part, bent away to the north-west and the Thompson pass. We descended by a shorter but more precipitous way, and on one steep glissade of about 300 to 400 feet, in attempting to save my pipe, which I had knocked out of my mouth with my ice-axe, I lost my balance and completed the last half of the descent in all sorts of positions, sometimes head first, and sometimes rolling over and over. Fortunately there were neither rocks nor crevasses, and the snow was soft, so no damage was done; and, what was also fortunate, nobody on the glacier below was quick enough to photograph me during my ignominious descent. Later, we got back to our bivouac, and, in order to avoid the very bad trail on the left bank of the stream, we crossed the snout of the glacier, investigating on the way a deep canyon through which the glacier stream flowed. Towards evening we were back once more in our tents at the head of Glacier lake.

On the next day, August 22, we broke up the camp, and, starting early on our raft, sailed gallantly before a westerly breeze, and, under the care of Dave, to the foot of the lake, where our horses were. That evening saw us again at Bear creek.

If time had permitted, we should have liked to visit our old haunts on Wilcox pass, where we were in 1898; but it was impossible, so we turned our faces once more to civilization, returning by the same route by which we had come. On the 24th we climbed an easy peak (Mount Noyes, 10,000 feet), which lies to the east and a little further up the valley than the Waterfowl lakes. From the summit an uninterrupted view of the country lying between Bear creek and the Sifleur river was obtained, and a portion of the country lying behind and to the east of Murchison I saw for the first time.

From this summit it was most evident how isolated Murchison was, and its series of rugged peaks stood up magnificently against the white clouds. Almost due north, and to the right of the most easterly point of Murchison, could be seen the highest of the peaks in the group lying between the Cataract river and the Saskatchewan. This peak overlooks the historic Kootenay plain. I have named it "Cline" peak.

It is curious how this small level plain, hidden away amongst the hills—the Kootenay plain—is now hardly, if ever, visited by man.

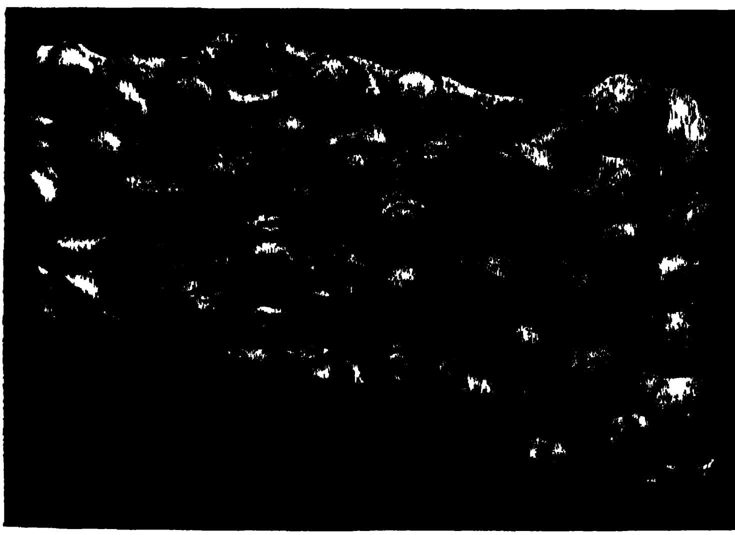
Perhaps once a year a few Indians come there for the hunting. Over half a century ago, however, it was very different; for on this Kootenay plain hundreds of the Kootenay Indians from the west of the Rocky mountains, after crossing the Howse pass, held their annual fair at this place with the fur-traders and the Indians from the eastern slopes of the Rocky mountains. This meeting had, even in Hector's days, been long discontinued, and he tells how Nimrod pointed out a large tributary of the Saskatchewan coming from the north-west, called the Waputeehk, or White Goat river (the Cataract river of Coleman), up which lay a trail to Jasper House on the Athabasca. To quote Hector's journal again: "Through this valley Nimrod said a trail runs to Jasper House, known as 'Old Cline's trail.' Cline was a trader that every summer travelled through the mountains from Jasper House to the Kootenay plain." This is now ancient history; not only have the Indians and the fur-hunters almost entirely deserted these upper waters of the Saskatchewan, but most of the game has gone too. Although Hector came across droves of sheep and rams on one occasion whilst sitting on the mountain-side just above the Kootenay plain, he says, "A flock of at least a hundred rams rushed close past me, so close, indeed, that I hit them with stones," yet even in these days the game had become scarcer than in former years. He also found traces of buffalo as well, but the Indians told him that, eleven years previously, "there were great fires all through the mountains and in the woods along their eastern base; after that a disease broke out among all the animals. Before that time (somewhere about 1847–1848) there was abundance of game in all parts of the country; but since then there has been a great scarcity of animals, and only the best hunters can make sure of killing." Probably nowadays the scarcity is partly due to the wholesale slaughter indulged in by the Indians, and there is no doubt but that some measures should be taken to stop it.

After the ascent of Noyes we returned to Laggan and civilization, but, having a few days at our disposal, we took our whole camp up to Moraine lake and Desolation valley, a spot that can be visited in one day from the chalet at Lake Louise. Our object was purely mountaineering; two fine peaks, Deltaform and Hungabee, being accessible from the head of Desolation valley. Owing to unsettled weather, we did not try to ascend either, but, instead, climbed a most interesting rock peak, Neptuak (10,500 feet), by the ridge that leads from a snow col between Desolation and Prospector's valley. On the moraine of the glacier in Desolation valley some most curious and apparently fossil remains were found in the Cambrian quartzites.

On September 5 we returned to Banff, our expedition ended. Our trip had been most successful; almost uninterrupted fine weather had lasted during the whole time; we had always been able to go where we wanted, owing to there being no trouble with either the commissariat

or the trails. A great number of questions relating to the peaks, passes, and glaciers had been satisfactorily solved. The chief points being: (1) The heights of Forbes, Murchison, Freshfield, and Howse had been barometrically determined; (2) the discovery of a pass across the range between the Lyell and Freshfield groups of glaciers; (3) the exploration of the Lyell glaciers and how the watershed ran from the Freshfield group to the Columbia group; (4) a much more detailed topographical knowledge of various outlying portions of the mountains; for instance, the portion south of the Freshfield group, that east of the Murchison group, also that north-east of the Wilson group.

If time permitted, I should like to have said something about the



FOSSIL REMAINS IN CAMBRIAN QUARTZITE, FROM DESOLATION VALLEY.

individual members of the expedition, how Hans was always in the best of tempers and a first-class guide, willing to do all things from hard work on the mountain side to transporting gigantic logs for the camp-fire or mending boots; how Dave told us most wonderful stories about the lumber camps, and how single logs could be used for the purposes of navigation instead of an ordinary boat; how Clarence spent many weary hours searching for the wary Indian "cayeuses" in the thick woods when they were determined not to be found; how Robson, who had been through the Boer war with Strathcona's Horse, had great things to tell of the prowess of General Buller, and the ignorance of those who knew not the peculiarities of horses and the various methods of "getting along" in the open veldt; and lastly, of the genial Fred,

to whom we largely owe the success of the expedition, always willing to do two men's work, always cheerful, and as good a hunter, trapper, and organizer of an expedition as one could ever wish to meet. It was worth travelling to the Rockies only to spend a fleeting month or six weeks in his company. May he continue to prosper, and may it not be long before we meet again.

Note on Rock Specimens from the Canadian Rocky Mountains, by Prof. T. G. Bonney, D.Sc., F.R.S.

Mount Freshfield.—The specimen from near the summit is a limestone. A pebble from the glacier with a speck, possibly sodalite, appears to be a crushed and decomposed diabase.

Bush Pass.—Two specimens, both calcareous, but one is perhaps from a superficial deposit.

Mount Forbes.—The specimens from near the summit are limestones.

Mount Murchison.—Pisolitic limestone, with small fragments of organisms.

Howse Peak.—Also a limestone with smaller fragments of organisms.

Mount Noyes.—A dark limestone containing a silicified coral, like a Lithostrotion; another specimen is also a limestone containing two or three very imperfect trilobites.

Neptuak.—The specimens are limestones. A blackish one on analysis showed traces of petroleum hydrocarbons, and after treatment with hydrochloric acid, left a deposit of amorphous carbon.

Desolation Valley.—These specimens are remarkable. One is a limestone breccia, slightly dolomitic like some of the others, the matrix being iron-stained; five are specimens of a white quartzite, two with worm-tubes running more or less horizontally, resembling those called Planolites; on three can be found an occasional worm-tube, one or two bilobed markings of an ovoid shape, and some which are parallel, elongated, and slightly triangular in form, probably the tracks of a crustacean. Another piece of quartzite of a greenish-grey colour shows on its surface the first and third of these markings. But the most curious specimen is a slab about 11 × 5 inches and 1½ inch thick (with a smaller fragment). It is a darkish, slightly ferruginous quartzite, which on one side passes quickly into a hard greenish argillite, and on the other rises into a number of mounds about an inch in diameter and rather less in height, having usually a slight indentation on the summit. They consist of quartzite continuous with that of the slab below, and an argillite like that on the opposite side apparently clings to their bases as if they rose through it. Some worm-burrows seem to pass along this, and once at least over one of them. The quartzite is found under the microscope to be composed of quartz grains in a felspathic matrix, the latter being now replaced by a minute somewhat micaceous secondary product. The mounds and tubes are mostly covered with a filmy ferruginous glaze. At first sight the mounds remind me of concretions in the magnesian limestone of Durham, but the microscope reveals nothing in favour of this idea, and shows the material to be continuous with the quartzite of the slab. The mounds then most probably are on the lower side of the slab, and casts of pits formed in the mud, very likely by worms retreating into it. Worm-burrows and the like are not very trustworthy evidence for the date of a rock, but I should think these specimens indicate some part of the

Cambrian system. Several of the limestones have a general resemblance to those brought by Mr. Whymper from the districts on either side of the Canada-Pacific Railway.

Before the reading of the paper, the PRESIDENT said: It is scarcely necessary for me to introduce Prof. Norman Collie to you, because he is an old friend, and we have already, within the last three or four years, listened to two very interesting papers from him. I think we may feel sure the paper he is about to read this evening will be equally interesting.

After the reading of the paper, the following discussion took place:—

Mr. STUTFIELD: You have heard from Dr. Collie an account of our expedition, and you have seen on the screen the map of the scene of our travels through the Rockies. Some of you may not know that the greater part of the country covered by that map was a blank five years ago, when Dr. Collie and Mr. Baker started. A large part of it was a complete blank, for the great Columbian icefield and the lofty peaks surrounding it were only discovered in our expedition in 1898. I think you will therefore agree with me that Dr. Collie has made a considerable addition to our stock of knowledge of this little-known part of the Canadian Rockies. I say little-known, because the thing that struck me most out there was the ignorance that prevailed concerning the mountains. I was trying to get some information for our trip in 1900, but the information I obtained amounted to absolutely nothing. I think even if you look on the best and most up-to-date maps that you can find anywhere nowadays of this part of the country, you will find the details extremely meagre, and such details as there are are very largely wrong. I was in the Society's rooms the other day, and, looking at one map, I saw Mount Hooker marked as 15,700 feet (?); I turned to another, and there I saw our friend Mount Murchison marked as 15,781 feet. However, with regard to these heights Dr. Collie has pointed out that we also made mistakes, and I am afraid it was owing to my mistake in 1898, owing to the smoke haze, we over-estimated the height of some of the mountains; but I think if we over-estimated them then, Dr. Collie has under-estimated them now. I know this much, that the weather was exceptionally fine during our trip, and the barometer exceptionally high, but I cannot help thinking that the differences of reading appear too great. The difference in one instance between the reading of 1897 and that of last summer amounted to about 900 feet, and that seems to give a very considerable margin for error. In the mountains the atmospheric conditions vary very much. Perhaps I shall be on surer ground if I say a word about the Rockies from the point of view of an Alpine climber. This year we were exceptionally fortunate in the weather, and having climbed several heights we were able to see the mountains to the best advantage, and to form a pretty fair estimate of what they were like. I think it may be said at once that, though they are very fine, they are not equal to the finest mountains in the Alps, that is to say, there is nothing in the Rockies quite so stately as the Matterhorn or the Italian side of Mont Blanc: and also, from what Mr. Ruskin would call the greased-pole point of view, they do not afford such fine climbing. Our climb on Mount Forbes was distinctly very difficult and also a sensational one; it would be so considered, I think, in the Alps. But for the majority of mountains they are not equal to the Alps in that respect, but in other respects the Rockies are superior. Those vast primeval forests with their wonderful undergrowth, with the magnificent trees and the tangled ruins of trunks, are things which you cannot find in Europe. The scenery of the Rocky mountains is exceedingly beautiful, and I cannot help thinking that future generations will be grateful to Dr. Collie, who has explored that great mountain system where

three immense rivers take their rise, the Columbia, the Athabasca, and the Saskatchewan.

Prof. BONNEY: I am sure we shall all feel grateful to Dr. Collie for having introduced us to a strangely beautiful country which seems to me to combine the scenery of the western Oberland, but with much finer glaciers, with the pines of the Dolomites. Surveying work such as he has been doing has a peculiar value. My own experience nearly forty years ago, in parts of the Alps which were then imperfectly mapped, has taught me the value of panoramic views. It is surprising how much information you can then bind together, and how many illusions are dissipated. However, I will not detain you with speaking upon those matters, but just say a word or two about the specimens he has brought back. It so happens that I have seen, though I have never been in the country, a good deal of the rocks from the mountains on both sides, and especially the north side, of the Canadian Pacific Railway. There is a very great similarity about most of them. They are limestone, and are curiously destitute of fossils. Mr. Whymper found one place only which yielded many fossils, chiefly trilobites, which were described in the *Geological Magazine* by Dr. Henry Woodward. Dr. Collie has brought back but very few fossils indeed from the north side of the Canadian Pacific; in fact, I might say that two or three from the neighbourhood of Mount Noyes are all, and those, though imperfectly preserved, are not improbably of a Lower Carboniferous age. But those from Desolation valley, on the south side, are remarkable and very difficult in some cases to determine. There are a number of worm burrows which agree with those which geologists call *planolites*, and perhaps it is safer to say they are worm burrows and nothing else. Besides that, there are some curious marks which I think most probably are the tracks of some large crustacean; and there are also some mounds like half-apricots which are dignified sometimes with the name of *bilobités*, which leaves you about as forward as you were before it was mentioned. Most likely they are tracks of some lowly organized creatures. And, lastly, there are those extraordinary hemispherical mounds. Among them are a number of worm-tracks. The mounds are formed of the very hard sandstone which is called quartzite. So far as I can make out, they are casts of pits made in a sort of clay. I think it probable they are made either by worms or by some other organisms, for I recollect to have seen pits something like them on the seashore. They are certainly the strangest things I have ever seen. I took a specimen to the British Museum, and found they had nothing of the kind in the collection there.

The PRESIDENT: We have to welcome a distinguished member of the Geological Survey of Canada, Mr. Ami, who, I believe, came to this country purposely to receive a medal from the Geological Society in recognition of his geological work. I hope Mr. Ami will address the meeting.

Mr. AMI: I must say I did not expect to be called upon to say anything here to-night, but it would be very ungracious on my part if I did not express my gratitude and thanks for the privilege and pleasure I have had in listening to the admirable lecture given by Dr. Collie, and also for the pleasure of again viewing those magnificent mountains in which I spent a summer south of the area described by Dr. Collie. These mountains, as you are aware, are called "Rocky." They are rocky from the base to the summit. They are to the east of the great Selkirk chain, which, if possible, surpasses them. There is here certainly very fine scenery; not only in the trees and forests are there great sources of wealth, but there are also many minerals. Before concluding I must say it has been a great pleasure to me to see those specimens brought back by Dr. Collie. I have over a thousand specimens from the regions of the Rocky mountains, which I myself

collected on Mount Stephen. I brought back probably 1500 specimens. The late Dr. George Dawson also brought back an interesting series of fossils, of which we hope a monograph will soon be presented to the world.

Colonel CHURCH: I have been listening to the very interesting lecture of Dr. Collie from perhaps a different standpoint from what has been expressed by the previous speakers, and that is its enormous value to the development of perhaps the most important colony of Great Britain. Whenever we have a lecture which is of practical importance showing the value of our geographical efforts to the world, we should call attention to it especially. If we look at the Dominion of Canada, we find that its communication with the Atlantic ocean is very difficult for at least four or five months of the year through the Gulf of Lawrence, owing to the ice and the fogs which make navigation extremely difficult. On the west side, we have a rocky mountain range, east of which is perhaps the finest wheat-field in the world. If that wheat-region had easy access to the Pacific ocean, it might almost supply the Orient with its bread stuffs, but unfortunately there comes this great mountain barrier which is the prolongation of the South American Andean system. It breaks down here [indicating on map] and then gradually rises up to Mexico about 7500 feet. (I am stating these figures from memory, so I hope you will excuse me if I make a mistake.) Again it slopes down in northern Mexico, and, entering the United States, we find the southern Pacific crossing the continent at an elevation of 5000 feet. Then we move north, and gradually the mountains rise again until the Union Pacific Railway crosses them at about 7000 feet elevation, and once more decreasing in altitude towards the boundary-line between Canada and the United States, the Northern Pacific Railway and the Great Northern cross them at about 5200 feet elevation. Then up go the mountains once more, barring the development of Canada from the Pacific ocean where the crossing of the Canadian Pacific is, I believe, at an elevation of about 5300 feet above sea-level. Now, the district explored by Dr. Collie is one of the first importance. I did not catch from him the elevation of the Bush River pass.

Dr. COLLIE: 7000 feet.

Colonel CHURCH: You see, therefore, that from the point where the Canadian Pacific crosses the mountains they rise rapidly, and when we go still further north, we reach a great depression in the Rocky mountain chain. The Peace river cuts through it, and the pass is about 2000 feet elevation, while just a little to the south is Pine River pass, 2600 feet elevation. Again the mountains commence to rise, so that it may be said that between the Kicking Horse pass and the Yellow Head pass, Canada has very little hope of reaching the Pacific ocean by any route useful for commercial purposes. So that Dr. Collie has presented to us to-night, as well as to the Dominion of Canada and the British Empire, most valuable information, of which I wish I could speak in terms that would make it appreciated in a geographical sense, in order that all might understand that the geography we learn here has its extremely useful side, worth a great deal more perhaps than England understands. If it understood it better, it would give us a geographical building adequate to our requirements. However, I want to say that through this Peace River pass we come to two lakes which lay practically upon the summit of the Rocky Mountain range, and then reach the Skeena river, by which we arrive at the finest port of the Pacific coast of the Dominion—Port Simpson. Here there are immense coalfields. I am only stating these facts to show what wealth there is in this country called Canada, which for so many years was called "our lady of the snows," which, by-the-by, is nothing but a derivation from the name of an old Spanish monastery. The wheat belt of Canada starts from here, runs to the southern end of James bay, thence north-west to Great

Slave lake, and then towards the Rockies; but west of Lake Winnipeg we have about 400,000 square miles of as fine wheat lands as there are in the world, which give just twice the crop per acre of the lands of the United States, and when I tell you the wheat crop of the United States is raised on 100,000 square miles of land, and here there are 400,000 square miles, you may well understand that Great Britain ought to get her bread stuffs from her own territory if she be a wise nation. I have tried to give you a little idea of the practical value of this splendid paper to which we have been listening, and thank you very much for your kind attention.

The PRESIDENT: We have listened to a most interesting paper, and also to a very valuable discussion. I think we must all feel admiration for the perseverance and ability with which Prof. Norman Collie has, during four successive expeditions, first explored this very difficult mountain region from a geographical point of view, and then has filled up all the topographical details by ascending lofty and difficult mountain peaks, by traversing very dangerous icefields, and by discovering at least one important pass. You will, I feel sure, pass the vote of thanks which I now propose to Prof. Norman Collie, by acclamation.

THE BRAZEAU ICE-FIELD.

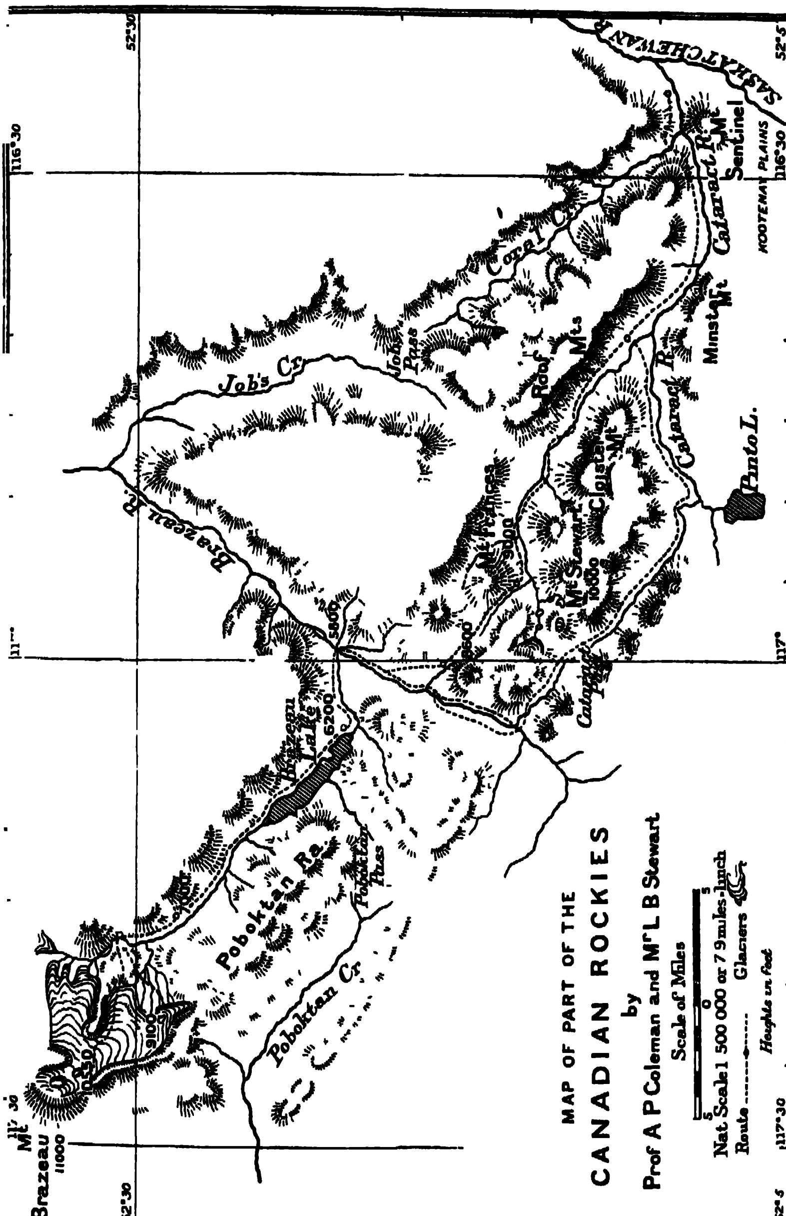
By Prof. A. P. COLEMAN, Ph.D., Toronto University.

DURING the month of August last summer, a brief trip was made to some hitherto unvisited valleys to the north-east of the region mapped by Wilcox * and Collie † in the Rocky Mountains, and about 50 miles of new trail were explored and mapped. The party consisted of Mr. L. Q. Coleman, his wife, Mr. Proctor Burwash, and myself, with four riding-ponies and as many for packing. As on former journeys, we travelled without guides or professional packers. Since my last journey in 1893 all the expeditions which have gone into the Canadian Rockies have made Laggan their starting-point, but we followed our former route, starting from Morley just east of the mountains, and making use of the trail made by the Mountain Stonies in their northern hunting trips. The route is longer, but the trail has certain advantages, since it is well beaten, has a drier climate than trails nearer the watershed, and presents a greater variety of scenery, including bits of prairie and foot-hills, park-like valleys near the "gaps" in the mountains, and a gradually increasing boldness of the mountain forms as one approaches the heart of the great range.

In the nine years since we had used the trail before some changes had taken place. In parts it had grown decidedly longer by the falling of dead trees, which the Indian philosophically goes round instead of using his dull axe upon them. A marked climatic change was indicated

* 'The Rockies of Canada.' 1900.

† *Geographical Journal*, vol xvii p. 392.


MAP OF PART OF THE
CANADIAN ROCKIES
by
Prof A P Coleman and Mr L B Stewart
Scale of Miles
Nat Scale 1 500 000 or 7 9 miles-1 inch
Route
Glaciers
Heights in feet
Saskatchewan R
Mt Sentinel
Cataract R
Kootenay Plains
Coral Cr
Minster Mt
Roof Mts
Job's Pass
Job's Cr
Pinto L.
Cloister Mt
Mt Stewart
Mt Frances
Brazeau R
Brazeau Lake
Poboktan Ra
Poboktan Pass
Poboktan Cr
Cataract Pass
Mt Brazeau
11000
9100
6200
5800

by the much more powerful cutting of the streams, which had often destroyed the old trail, and had even chosen new channels through the woods, undermining the trees and making wild confusion of their tangled trunks. For several years the rainfall of Alberta has been much above the average, setting springs and streams flowing in what were formerly dry "coulees." It can hardly be expected that this abundant rainfall will be permanent, however. Our month was marvellously fine for the mountains, only one day being lost by rain, a record which may be contrasted with Collie's experience of continuous rain on the Columbia side of the mountains two years before.

As the earlier part of our route has been described before,* nothing further need be said of it, except to mention the unusual height of the Saskatchewan on August 11, when we crossed it. We found fifteen lodges of Stony Indians camped on the Kootenay plains near the foot of Sentinel mountain, but on the wrong side of the great river, which had not yet been fordable. As we passed they were just breaking camp in picturesque confusion, dogs barking, women taking down the canvas from the conical frame of poles, and looking up piebald or buckskin ponies to pack their household gods upon, and men putting their saddles on riding-ponies. After shaking hands with my old friend Jimmy Jacob, we secured Sampson Beaver to guide us over the ford, his sister, Becky, a bright-faced girl who talked some English, bestriding her horse and coming along as interpreter.

The river can only be forded where split up into numerous channels by low wooded islands, and before leading us over Sampson tried the ford himself, partially stripped so as to swim with his horse when he lost his course in the muddy water. He was a very lively and graceful bronze statue as he made his way across, but quite belied his name as far as physique was concerned.

Coming back, he led the way, and our band followed with no mishap, except that a pack-pony, edging too much down-stream, got into deep water and had to swim.

Our course now turned up Cataract river, following a poor trail seldom trodden of late years, scrambling down into canyons to cross tributary streams, but usually keeping on the rough talus slopes of the mountains, or along moraines hundreds of feet above the boiling river. The fine doublefold of Sentinel mountain stood just opposite us, and on ahead were splendid cathedral-shaped mountains, the most prominent of which we named Minster mountain. This peak is well seen from the prairie land of the Kootenay plains.

Instead of following up the west fork of Cataract river leading to Cataract pass, we took the north-west one through a wide unexplored

* *Geographical Journal*, vol. x., "Mount Brown and the Sources of the Athabasca," pp. 53–60.

valley, intending, if possible, to follow it to its head, and then seek a new pass to the Brazeau. Remnants of a very old trail showed that the valley had been entered by Indians, and teepee poles rotting on the ground at two points where there was some grass indicated their halting-places.

The trail can be followed only for short distances, and a good deal of chopping was needed to open a way for ponies, while at one place we had to lead them among the boulders along the edge of the river, here a raging torrent. To the north-east the valley was walled by an unbroken range of highly tilted mountains like a steep slate roof; but to the south-west the cathedral type prevailed with a gentler dip.

FOOTHILLS, LITTLE RED RIVER.

For 10 miles the valley is straight, following the strike of the mountains, but it then curves to the west, and the river splits into small creeks. Here we scrambled up a steep-wooded slope, and camped at 7200 feet, not far below timber-line. On the brow of a hill overlooking the valley and opening out a wide mountain view, we found several great springs gushing out and forming thick beds of travertine.

My brother climbed the mountain to the north-west, finding it to be 9000 feet high, naming it Mount Frances; and later we explored the main stream in the valley, following it up through a chain of lakes, the lowest at 7000 feet with forest-covered shores, then a very striking waterfall and a lake at 7500 feet, completely rock-enclosed, and fed by streams from a glacier a few hundred feet higher. Making our way around the cirque-like valley over very rough talus, we found another lake to the south-east just above tree-line, the most striking of them all, with blue-green water and a cliff 1500 feet high on one side. The lakes, though only three-quarters of a mile long, are as magnificent in their

way as Lake Louise near Laggan. All but the lowest one occupy rock-basins hollowed by small glaciers when the snow-line was lower than now.

Following a small stream north-west from the camp with our ponies next day, we soon rose above timber-line on our way to the lowest yoke of the mountain wall between the Cataract valley and the Brazeau. Though the rough small stones, uncovered with vegetation for the most part, annoyed our unshod ponies, we presently came to the foot of the ridge, and then scrambled up the slaty talus slope to its summit, where we had to decide whether to risk the unknown descent to the Brazeau or turn back the way we had come. The elevation of the yoke is 8600 feet, nearly 1000 feet above the highest pass we had crossed with ponies hitherto, and there was no sign of a trail suggesting that Indians had gone that way before.

From the ridge we had a glorious view of the mountains around. most of them from 9000 to 11,000 feet high, and carrying small glaciers; of the densely wooded valley of the Brazeau, which flowed about 2 miles off, but nearly 3000 feet below; and of Brazeau lake and the great glacier beyond it gleaming in the distance, the goal that we had set before ourselves in the beginning.

We quickly decided to risk the descent, and soon our ponies were slipping and stumbling down the steep slope, partly over soft snow-fields, but often over loose *débris* which rolled and slid beneath them. Reaching the valley of a snow-fed stream, we had rather better going, until this cut its bed down into a canyon, and finally plunged over a vertical fall of 100 feet or more. After trying in vain to pick a trail over the mountain, we at last led our tired and footsore ponies down the bed of the torrent, almost to the edge of the fall, and then made them scramble up to the right, where a small shelf gave a foothold to a few trees. From this it was easy to reach the forest slope, and as darkness fell we pitched our camp among the spruces, glad to have conquered, but not anxious to go back over the route again.

We were still 1500 feet above the ford of the Brazeau, near its forks, but two hours of steep descent among the trees brought us to the trail along the valley, the best beaten highway since leaving the Saskatchewan. Even here fallen timber gave us great trouble, but at last we reached the ford at 5830 feet, and turned up the valley of the north fork of the Brazeau to the lake of the same name. The trail is in better condition from the forks to the lake, and for 5 miles along the lake-shore than elsewhere; but from the delta of the north fork at the upper end of the lake, the trail is faint and hard to follow. Keeping to the left side of the valley, we came to a full stop about 6 miles up, a huge moraine of blocks of limestone as large as a cottage lying right across the valley. We were still several miles from the glacier, and it was necessary to get nearer it if possible.

At last a vague track was found among the boulders leading over the moraine, and beyond it an enchanting little valley with half a mile of prairie for the horses, thick groves of rather stunted spruces for fuel, and as a water-supply a clear stream leaping into the valley in a lofty waterfall, and ending in a pond without a visible outlet. Doubtless the pond drains through the moraine to the river below.

Our moraine camp was at about 7000 feet in what was probably the ancient river-valley before the moraine crossed it. Since that event the river has broken its way through, and cut an almost impassable canyon half a mile to the south. From this beautiful camp we had a broad view of the ice-field 4 miles to the north-west, and laid our plans for an attack upon it next day.

BRAZEAU SNOW-FIELD, FROM MORAINE CAMP.

We were rather late starting in the morning, having lost time in improvising alpenstocks from small spruces and steel nails, so that by the time the valley had been skirted and a rocky ascent climbed to the edge of the nearest glacier it was nine o'clock, and the sun was already strong. On our way we passed a very desolate lake half a mile long. The ice-field is broken by a long and very precipitous mountain ridge, the foot of which we decided to follow on our way up. The going was good for a mile on the bare glacier until the snow was reached, when the slope became steep, and the soft snow made very heavy walking. Tiring of this, we tried the mountain-side, but, after wasting some time, found it impracticable, and returned to the snow. At one o'clock we reached the top of the ridge which nearly cuts the snow-field in two, and found ourselves 10,000 feet above sea-level. The highest point of the mountain rose less than a mile to the north-west, but in very forbidding cliffs, so it was decided to attack it by a slope of snow on the south side. At our present elevation the snow was harder than

before, and the walking was fairly good, though we had to make a circuit round some large crevasses. Soon the slope became steeper, so that footholds were hard to make, and the surface, softened in the sun, begun to slip in great sheets beneath us, threatening to sweep us with it. Halting on some projecting rocks at 10,550 feet, we considered the situation, and concluded regretfully that further climbing was too dangerous to be risked. A clinometer reading from our earlier halt makes the top of Brazeau mountain, as it may be called, more than 11,000 feet, so that we were still several hundred feet below the top when we turned back.

From our perch on the rocks there was a magnificent view of the central Rockies, including the Columbia ice-field, and the bearings of a number of points were taken; but there were very few summits rising prominently above the rest, and we could not be sure of the mountains marked by Collie 20 miles to the south.

Immediately below us we had the Brazeau snow-field, 8 miles in length and 4 in breadth, rising into two white mounds towards the south, and sinking away to dirty surfaces of ice in the valleys to the east, followed by muddy torrents forming the headwaters of Brazeau river. Toward the north there was a profound and desolate valley, whose outlet we could not see, and to the west the green valley of Poboktan or Owl creek, a tributary of the Sunwapta, the eastern branch of Athabasca river. The Brazeau snow-field sends most of its drainage into the Saskatchewan and Hudson bay, but part into the Athabasca and the Arctic ocean.

The mountains toward the east were somewhat lower than toward the south and west, but almost every peak in sight carried snow-fields and glaciers; none of them, however, except in the far south, as large as the one we had traversed.

Glissading on the steeper slopes and wading through the soft snow on gentler parts, we made haste to reach camp before nightfall, but had one mishap before leaving the snow-field. I was in the lead, following our morning's footprints somewhat carelessly, when I plunged through the snow into a wide crevasse which we had crossed on the snow-bridge going up. Fortunately, my alpenstock crossed the chasm as I fell, partly supporting me, and my brother and Mr. Burwash tightened the rope and quickly helped me out of my uncomfortable position.

After more than eight hours on the snow, we were glad to reach the rocks again near the end of the glaciers, and, passing the small lake, made our way to camp just at dusk, where a splendid dinner of mountain sheep awaited us.

On the following day I waded several of the glacial streams and climbed to the lowest col towards the south-west, so as to complete my map. The route included 1½ mile of glacier and snow-field, and crossed a small nunatak, evidently not long free from *névé*, but lichens, mosses,

phloxes, daisy-like flowers, and a yellow composite are already growing on it. The col is at 9800 feet.

All the glacial tongues show signs of recession, a bare morainic belt reaching for a few hundred yards below; and the tree-covered moraine 4 miles away near our camp evidently indicates a much greater development of the ice some hundreds or thousands of years ago.

On our way back to Morley we followed up the west fork of Brazeau river and crossed Cataract pass, halting for a day to climb a mountain near the head of the pass, so as to complete our map of the region to the north-west. Our camp was at about 7000 feet, and the mountain, whose top is not more than three-quarters of a mile away, reaches above 10,000 feet. Unfortunately, an impassable cliff met us at 9830 feet on the west side

UP THE SASKATCHEWAN, FROM KOOTENAY PLAINS.

where we attacked it, and we were obliged to content ourselves with the view up and down the pass and across the opposite range toward the great snow-fields of the central Rockies. We named the point Mount Stewart, after our former companion, Prof. L. B. Stewart, who had prepared the original map of the region.

From Mount Stewart we made a start for home, with slow travelling on the bad trails to the Kootenay plains, but averaging 30 miles a day for the last four days, our ponies having by this time very light packs.

It is worthy of note that the mountain sheep, which have been little hunted of late years beyond the Saskatchewan, are becoming numerous and tame. We came within fifty yards of an old ram on the north-west fork of Cataract river, and had a close view of a flock of seven on our way up to the high pass toward the Brazeau. Another flock of five ambled away from us soon after we started our climb of Brazeau

mountain. Their khaki is splendid protection on rocky mountain-sides, but betrays them when feeding on green lower slopes.

In closing this paper, attention should be called to a statement made by Prof. Collie in the interesting account of his last work on the Columbia side of the Rocky mountains, that his previous explorations were on the *eastern* side of the Rockies.* In reality his excellent map covers only the central ranges, and there are several parallel ranges to the north-east, each somewhat lower than the former one, until the last, rising only to about 8000 feet, presents the great wall of rock toward the prairies from which the name Rocky mountains was derived. These north-eastern ranges have a width of 35 miles, as shown in the Brazeau valley, and include three or four ranges separated by lateral valleys to the north-east of Brazeau lake, the last point which he shows.

It is worthy of mention that on his map, as well as on the map published by Wilcox in his sumptuously illustrated 'Rockies of Canada,' through some oversight no credit is given for the parts taken from the map prepared by Mr. L. B. Stewart for my last paper,† though the whole of the region around Athabasca pass, Fortress lake, and the Brazeau and Cataract rivers has been copied from it, including passes and elevations. It is due to Mr. Stewart that his pioneer work should be recognized, when others who have done less work in the region are referred to as authorities.

I wish to say a word, also, in regard to nomenclature. The Canadian Pacific authorities have introduced the name Wapta for the Kicking Horse river, apparently unaware that Wapta is simply the Stony word for "river" in general, and should not be applied specifically to one of the minor rivers of the region. Collie has employed the name also for an ice-field near the source of one fork of the river. Finally, Wilcox uses the name Whirlpool river for the Sunwapta, or east branch of the Athabasca. As the same name has long been applied to a tributary coming into the Athabasca from the Committee's Punch-bowl to the south-west, it is evident that the new use of the name can only make confusion.

TRAVELS ON THE BOUNDARIES OF BOLIVIA AND ARGENTINA.

By Baron ERLAND NORDENSKIÖLD.

THE boundary between Bolivia and Argentina is remarkable for its great diversity, as within a restricted sphere the traveller meets with vast tablelands, snow-clad fells, wild mountain valleys with luxuriant

* *Geographical Journal*, vol. xvii p 252.
† *Ibid.*, vol. v No. 1.

primeval forests, enormous plains, overgrown with brushwood, etc. Thus far did the rule of the Incas formerly extend to the south-east. On the mountain plateaus lived people tributary to them, while independent tribes inhabited the mountain valleys and the Chaco. To this very day various Indian races live there, widely differing in origin, manners, and customs.

Varied scenery, innumerable fossils of pleistocene mammals, memorials of a prehistoric culture, and Indians—who had had little contact with civilization—were the inducements that enticed myself and companions to start for the spur of the Andes towards "El gran chaco." There were five of us—R. E. Fries, botanist; Count Eric von Rosen, ethnographer; G. von Hofsten, ornithologist; myself, zoologist; and E. Boman.

These parts have not been visited by many investigators. Those of most importance are Weddel, Crevaux, Lorenz, Hieronymus, Brachebusch, Uhle, and Borelli. Certain portions of this borderland, even if well known as regards geography, are in other respects but little studied, the least-known regions being often found in close proximity to civilization.

On March 25, 1901, Fries and I left Stockholm; von Rosen and von Hofsten not starting from Sweden till August 15, and joining us at Salta on September 25. Boman was a member of the expedition from May 8, 1901, till February 16, 1902, when he left on account of ill health.

As it is quite unnecessary to encroach on the space of this journal by any description of our voyage out, let me beg the reader to join us at Salta, a small town in North Argentina, which formed the basis of our excursions on the boundary between Argentina and Bolivia.

On May 12 Fries, Boman, and I arrived at Salta, chief town of province of same name, having 16,000 inhabitants. We at once began our preparations, engaging servants, procuring mules, provisions, etc.

This having been duly accomplished, we started from Salta on May 23, next day arriving at San Pedro, close to Esperanza sugar mills in Jujuy province, whence we rode towards the left to the northern extremity of Sierra Santa Barbara, which ridge here forms the last spur to the Chaco. So as to reach the sierra from San Pedro, we were forced to cross the Rio San Francisco, which river, not very far from the northern extremity of Sierra Santa Barbara, unites with Rio Bermejo and, bearing the last-mentioned name, flows on to Rio Paraguay and the Atlantic. To the west of Rio San Francisco there are several important places, but east of it only small settlers' huts and a tract that to my knowledge has hitherto been visited by no other scientist than Brachebusch, the geologist, who, in 1886, travelled through the most northern parts of the Argentine Republic, his mission being to study the occurrence of petroleum. Our knowledge of the geography and geology of these regions is all based on the results of his travels.

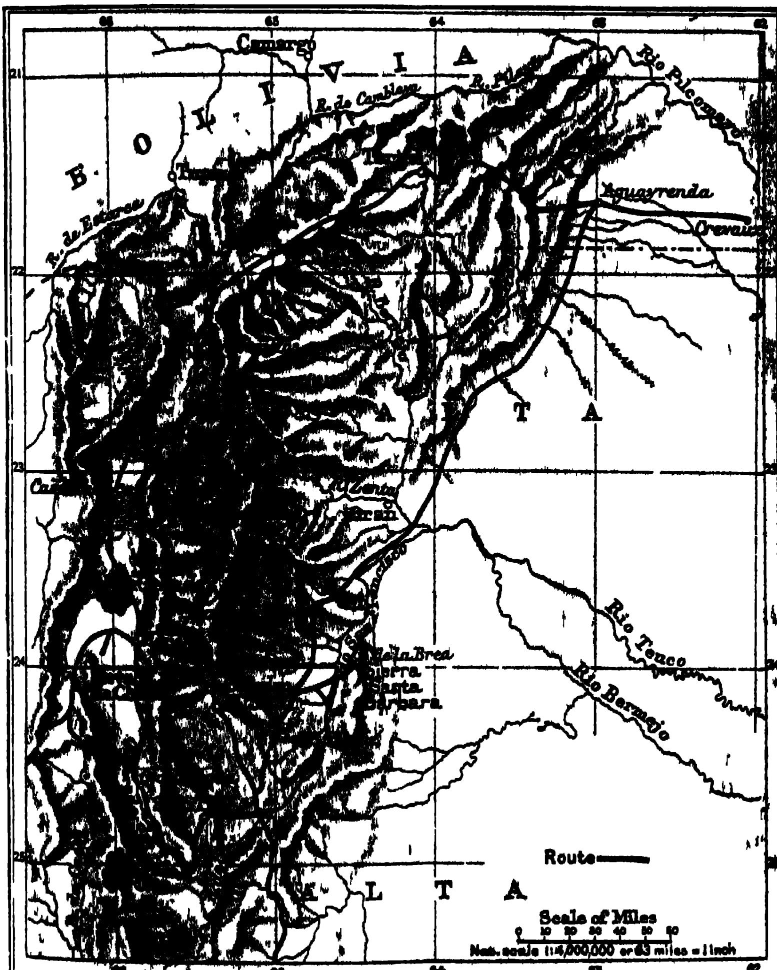
At Quinta, a small rancho in the primeval forest, we pitched our camp, and our scientific investigations were carried on either in its proximity, or during excursions in the neighbourhood. Near Quinta there are several hot springs, some with fresh, others with salt water. Some 3 miles off, or rather more, there is Laguna de la Brea, a small lake containing water, petroleum, and dissolved salts, flowing into it from certain springs. Animal life in the hot springs is very poor in species, but rich in individuals. Water of a temperature of close upon 50° C.* was inhabited by a small crustacean, an ostracode. Some of the hot springs at Quinta cause the formation of a lakelet, the water of which is saturated with salts. Animal life in the lakelet is far richer than in the springs, even as regards species, the number of individuals being very large. We found here a viviparous small fish, a mollusc (*Hydrobia* sp.), etc. It is very interesting to observe, in such a salt lakelet as this—which also has a supply of fresh, pure water—some forms of life which later on, in the struggle for existence, play a subordinate part, here, thanks to their being inured to the salts, developing in vast masses in the salt water. These forms, able as they are to exist under very different conditions of life, and proceeding from a large number of species, in all probability would continue to exist even if a general change were to occur of those conditions common to animal life in fresh and salt water.

Laguna de la Brea is devoid of macroscopic animal life. Vegetable life seems to be limited to one or two algæ, and a colony-forming bacterium. Microscopic animal life is likewise very poor here. Fresh water is rich in individuals, but not so rich in species as in Europe, probably because there are few large water-basins, and those there are offer but small variation of the outer conditions of life, thus giving little opportunity for the development of new species.

Quinta, as previously mentioned, is in the primeval forest, a lofty wood following the sierra, while at some distance from the ridge, the brushwood begins, the forest accompanying the more stony and the brushwood the looser ground. In the forest animal life is not so abundant as is fondly imagined on first reaching the tropics. We were at Quinta, however, during the dry season, when everything lies dormant, and the animals must be sought for in their hiding-places. The dry season here occurs in winter, but the hibernation of lower animal life is caused by the drought, and not by the relatively cold nights. In the damp meadows almost exactly the same abundant animal life prevails as during the rainy season: the snails here do not creep down into the soil and place a "dry-season lid" on their shells, as is the case in the forest and on the slopes.

* At this temperature there are numerous ostracodes, and at 51° C. some single individuals.

The Creoles had spoken to us of old dwelling-places, so-called "antigales" where treasure had vainly been sought. We made as systematic an investigation of them as the shortness of our stay permitted, and succeeded in bringing to light much that was of interest. These



SKETCH MAP SHOWING THE ROUTES OF BARON E. NORDENSKIÖLD IN ARGENTINA AND BOLIVIA

dwelling-places are very numerous, and some seem to have been of importance. An armadillo (*Dasypus sexcinctus*) shows the scientist where such dwelling-places have formally existed, as, when digging its hole, the animal throws up pieces of pottery embedded in the soil. Nothing

above ground now testifies to where the villages have formerly been situated, except possibly the remains of some mound or other in the primeval forest. In all probability the culture of these ancient inhabitants was pure Chacensic, though greatly influenced by those Calchaquis living in the west. The most interesting discovery, made by Boman, was that of a burial-place, where, above the skeleton of a full-grown individual, five urns containing children's skeletons were brought to light. One of these urns had been taken out before our arrival, and was then in the hands of a settler. Some of the urns are said to have been broken by people digging for treasure. These urns are ornamented with fantastic faces. The children's skeletons are somewhat burnt. Among the ornaments are some specimens of a sea-shell (*Oliva* sp.), which has probably been obtained by barter from some tribes living in the west. It was a very usual thing with the Calchaquis to bury children in urns; but the burial urns used by the Calchaquis are different to those used here on the borders of the Chaco. Whereas the ornamentation of the Calchaquis is intricate, with fine, beautifully composed animal figures, here we found a plain, purely linear ornamentation. The Calchaquis ornaments are, as a rule, painted; while these are simply cut in the vessels. Another burial-ground was also examined, and there, among other things, we found a skeleton with a pipe-like object in its mouth. On closer examination this proved to be the upper part of a human humerus, from which the spongy tissue had been extracted.

Excavations of dwelling-places resulted in much that was of interest, proving that the art of modelling occupied a rather high position. As a general rule animal motives have been chosen. Ornaments seem mostly to have consisted of shells. Objects of copper are very rare. When the Spaniards conquered these and other adjacent tracts, it is probable that this slight culture as Lafone Quevedo supposes to have been the case with the culture of the powerful Calchaquis— had already reached its culmination, and was on the wane. The dwelling-places all lie at some distance from water, which proves either that the streams have changed their courses, or that the rainfall is now less. Ten Kate made an almost similar observation in the Calchaquian valleys.

During our stay at Quinta, Fries and Boman undertook a long excursion over Sierra Santa Barbara; the alpine flora and various regions of vegetation were studied by our botanist. From Quinta we started for Esperanza, and after some delay on the road we finally arrived there on August 31. By far the larger number of the hands at this large sugar-mill are Indians, Matacos, and Chiriguans. They come from Bolivia and Chaco in search of food, and then get work. Indians are not bad workers. This contact with civilization, however, greatly demoralizes them; they are decimated by smallpox and a kind of galloping consumption. The mill-owners are Englishmen—Leach Brothers, known for having descended the Bermejo through the Chaco to Paraguay

After a time we returned to Salta, where we found von Rosen and von Hofsten. Having made final preparations with regard to fitting out the expedition, we left Salta for Puna de Jujuy. We chose the route through Quebrada del Toro, and not only in the Salta valley, but also in this quebrada, excavations were made. These quebradas leading to the tablelands are of a peculiar character. The rich vegetable life of the lower regions reigns part of the way, but by degrees the landscape becomes monotonous, columnar cacti being seen in vast numbers.

Our second headquarters were made at Moreno, about 11,500 feet above sea-level. The kind of rock prevailing round our camp was quartzite sandstone containing trilobite, and as this is much compressed,

OJO DE AGUA, PRE-COLUMBIAN PUEBLO IN QUEBRADA DEL TORO.

good fossils are rare. The vegetable formation is a "puna," a dry high-lying plain with low bushes. The central point of the puna contains a large salt lake or salt marsh, the shores bearing sparse halophyte vegetation. Animal life is very deficient, but comparative studies of the forms found here and those occurring in the valleys and the Chaco would doubtless prove of interest. High fells surround this elevated tableland, the highest being Nevado de Chañi, about 20,000 feet. The mountain slopes bear numerous cacti, many with beautiful flowers. The rainfall in the puna is very slight, the puna forming a closed water-basin. The streams are few in number and come to an abrupt termination. Much weathering is apparent, but the brooks simply carry down to the plain

fine silt and sand, leaving stones and gravel in the vicinity of the mountain, the salina only receiving the salts dissolved in the water. There are large fields of drift sand. The plain is so utterly devoid of large stones that, on seeing a stone in the immediate vicinity of the salina, you feel convinced that it is a stone axe or remnant thereof, or that very near there is the site of a dwelling, and that the stones have been brought there for building purposes. The central portions of the salina consist of common salt, while the outer, at any rate on the east side, are of borax. The salt crystallizes into visible layers, from which the Puna Indians hew out blocks of about 25 kilogs. in weight, two of these forming the ordinary burden of a donkey. These Puna Indians, the descendants of the ancient Omaguacas, then take the salt to the valleys for sale. In prehistoric times salt-mining must have been carried on here, judging from the large, heavy, broad-headed stone axes found on the shores of the salina. Similar stone axes—judging from what Chantre asserts—have been observed in salt-mines in Armenia, as also in mineral salt-mines of Austro-Hungary (Much). Borax occurs at times in streaks in the soil, but the really lucrative borax crystallizes in balls of irregular size, which are got at by digging and collected in sacks, like potatoes.

Evidently the Puna has never been covered by ice, as no moraines, no erratics whatsoever, are discoverable. When stones do intervene, they are invariably traceable to the brooks. Glaciers have existed in the Cordillera valleys lower down, as is evident. There erratics are seen high up on the rocky hills, where no water could have placed them. Enormous masses of material are found here, which, totally unsorted as it seems, is probably of glacial origin. Let me observe, however, that so close to the tropics such different conditions prevail to those of Europe that an unschooled geologist like myself cannot perhaps correctly comprehend those formations which are apparently glacial. Probably a tract free from ice has occurred in the Puna about 3500 metres above sea-level, surrounded by valleys filled with glaciers.

The Puna has formerly been pretty numerously populated. E. von Rosen examined two important dwelling-places, one at Casabindo, the other at Ojo de Agua, I myself making collections from some that were smaller. Casabindo is well known from the excavations of Max Uhle; also Ambrosetti and Lehmann-Nitsche has described a lot of interesting things at this place. Contrary to what holds good of those at Quinta, these dwelling-places are situated on those few streams and wells which never run dry the whole year, never in the proximity of those that are only available at certain times, which are far more numerous. This fact is a proof that no change in the rainfall has taken place since these spots were inhabited.

Casabindo has formerly been a very important place or town. Long after the invasion of the Spaniards an independent Indian culture reigned

in these tracts. In a grave in a grotto we discovered various purely Indian objects, as also a cow-horn. The dwellings have been built on the slope of the mountain, and each family has had their burial-place close to their hut, generally in a small cave. Vast terraces have been formed for purposes of cultivation. The climate of the Puna being very dry, numerous articles of wood and skin have been preserved to our day. The ceramic art has not reached so high a state of development as at Quinta. The ornaments are few, not graven, as is the case there, but painted. Many articles of skin and wood certainly owe their origin to the valleys, and have probably been obtained in barter for culinary salt. The Omaguacas (Humahuacas) were probably a tribe subject to the Incas,

THE VALLEY OF TARIJA.

but do not seem to have adopted their high degree of culture to any appreciable extent. Sea-shells were found in these graves also, as with the Calchaquis (Moreno). At Casabindo von Rosen obtained a large number of human skulls, most of them artificially compressed. Children's bones in perfectly unadorned urns were also met with here.

The Puna Indian of the present day is a Christian, but retains many heathen customs. He has a cross of cactus wood on the roof-tree of his grey stone hut, but outside the door there is a sacrificial altar to the earth-goddess Pachamama, to whom he constantly makes offerings and, in his heart of hearts, considers supreme. They now possess but few objects of their own original manufacture, but the stuffs woven by them

are of patterns with composite animal designs which denote an independent culture long since passed away. In the passes large cairns are constantly found, and every Puna Indian, on passing, adds a stone and a coca leaf, so that neither he nor his beast of burden may tire on the way. In some passes there are small squares of stone erected, into which the Indians throw their coca quids. There are some passes which they deem it impossible to traverse in safety without making an offering. I once tried to calculate the stones in such a heap, and found there were more than 50,000. Twigs ornamented with red tassels are also stuck into these heaps of stones, and domestic animals are adorned with similar twigs in honour of Pachamama. Evil places exist, and no Puna Indian ventures there; grottoes and high mountain-tops being reckoned as such. The grottoes at Quatchichocana have been in such bad repute that a priest had to come and exorcise the evil spirits. Sleeping in the vicinity of the Pachamama stones is considered dangerous, as spirits reign supreme at night.

At a place called Organoyo, von Hofsten ascended a mountain in spite of protests from the Indians. As he placed his foot on the topmost peak of this mountain, one of our mules fell into an abyss and perished. However, it is not always Pachamama that is the avenging goddess. In the slopes round Tarija (*vide* coming pages) it sometimes happens that some one falls over a precipice; the Indians then declare that this is the work of evil spirits, and verily they must be numerous, since every precipice has its own special presiding spirit.

Many peculiar customs obtain with respect to the harvest. In Tarija, for instance, where the population, though somewhat mixed, is closely allied to the Puna Indians, when harvesting begins, a cross is set up in the maize-fields, and on it all maize-spadices growing as twins are hung. These are called Pachamamas, and bring good harvests. The Puna Indians are industrious, though dull witted, unreliable, unexpressibly dirty, and never take a bath.

Numerous excursions were made from Moreno to most parts of the Puna. Nevado de Chañi (20,000 feet) was climbed by von Rosen, Fries, and von Hofsten. They reached the summit, and there found the remains of two altars or something similar, round which there were some pieces of earthenware, a bead of blue-green mineral, and—on and around the altar—a supply of cactus wood, etc. The so-called altars were built square, one side being open, and placed sideways with regard to their mutual position, thus not directed towards any special point of the compass. On one of the fragments of pottery a wedge-shaped ornament was painted. Similar patterns had been observed by von Rosen on pottery from Ojo de Agua, as previously stated, a large pre-Columbian dwelling-place at Quebrada del Toro. Beads of a similar kind are invariably found in all places and burial-grounds. The wood lay both inside and piled round the walls, and—probably owing to the

air at this elevation being peculiarly free from bacteria—it was in a very good state of preservation. Evidently this had been an ancient place for sacrifice or signalling, prior to the invasion of the Spaniards. At the top, consisting of granite, Fries collected lichens.* The flora was poor above the snow-line, which was at about 18,400 feet. A butterfly was found on the snow. Another excursion undertaken by Fries, von Hofsten, and Boman was pushed as far west as Puna de Atacama.

On November 25, for purpose of equipment, von Rosen, Boman, and I

CHOROTE INDIAN, BOLIVIAN CHACO

returned to Salta through Quebrada de Pumamarca. We left Salta on December 18, Boman going *viâ* Quebrada de Pumamarca so as to join Fries and von Hofsten in Moreno, while von Rosen and the author of these lines travelled through Quebrada de Humahuaca. At an Indian hut we tried to induce an old woman to sell us a "piedra del raye," or thunderstone. It surprised me that the Indians of the Puna did not

* The spot reached by von Rosen, and which was then deemed the highest peak of the mountain, lies north-west of real summit, where the mineral is quartzite sandstone.

regard the arrow-heads as supernatural, but simply considered them as derived from the ancients, their forefathers. That which the Indians call thunderstone consists of pieces of red hematite. They are met with in the old dwelling-places, and the belief in their having come with thunder is prevalent among all the Indian tribes in these parts, as also among the Creoles. Probably this idea has originated from meteor stones having been observed to fall at one time or other, and therefore it has been supposed that all stones with the habitus of meteor stones have a similar origin. The old woman refused to sell her thunderstone, declaring that she pulverized it and used it as a remedy for rheumatism.

At Cangrejillos, near the Bolivian frontier, we all met and started for Bolivia, arriving on January 8, 1902, at Tarija, camping in the vicinity of the town. The valley of Tarija, famous for its fossils of pleistocene mammals, is about 6200 feet above sea-level, the surrounding mountains being some 10,000 to 13,000 feet in height. The trees are mostly mimosas, though, in damper places, other kinds of trees occur, cacti being very numerous.

As previously stated, Tarija is famous for its fossil mammals. Weddel was the first to make collections, when, in the capacity of botanist, he visited this valley in 1875. He obtained a vast number of fossils, and, after unheard-of difficulties, succeeded in transporting them to Paris, where they now are, having been duly classified and described by Gervais. An essential part of the material which formed the basis of Burmeister's palæontological works was also derived from this region.

The soil of the Tarija valley consists of fine dust, with belts of sand and gravel. Water has intersected the valley in all directions, forming the most fantastic landscape, with rifts and labyrinths. In the upper strata of the soil, the water has in many places brought fossils to light. Our work here was crowned with success, as we obtained skulls and skeletons of various forms, especially of *Mastodon andium Equus curvidens*, and of some giant edentates—*Megatherium americanum*, *Mylodon robustus*, *Lestodon armatus*, *Glyptodon clavipes*, and *Scelidotherium capellini*. Good material for studies on the individual and sex variation of the *Mastodon andium* was obtained, as also of *Equus curvidens*. These forms are especially interesting, since they emigrated to South America at a rather late period, and it is possible to follow a parallel in development and obtain material for comparison with contemporary or almost contemporaneous forms in North America and Europe. Besides the fossils already mentioned, we came across parts of the skeletons of *Hippidium principale*, *Eutatus* sp., *Dasypus* sp., *Auchenia* sp., *Macrauchenia patagonica*, *Machærodus neogeus*, etc.

In Tarija man has evidently not been contemporaneous with the mastodon and other gigantic animals. When factors of species and bones of fossil mammals are met with together in these regions, a

secondary admixture is always traceable. This is what has occurred in the grottoes of Ultima Esperanza in Patagonia, but, curiously enough, those that examined this grotto after my investigations have failed to comprehend this fact. During the time of the Incas, a very high degree of culture obtained at this place. Von Rosen succeeded in making very good finds at the dwelling-places, more especially of arrow-points of chalcedon and obsidian, as also of spindle discs and animal figures cut in potstone. Objects of copper or copper admixtures were common,

ON THE ROAD TO OREVALA

having probably a purely Incan origin. Ornaments, amulets, beads, etc., were of stone, whereas at Quinta they were of shell, as now used by the Chaco tribes.

On February 24, 1902, we left Tarija for the Bolivian Chaco, the route lying across the fells; vegetation was very varied, the most glorious primeval forests and sombre highland fells being traversed. In these mountain valleys we learnt to know the Chiriguan Indians. As is well known, they speak Guarani, and come originally from the east.

The Puna Indians have formerly spoken Quichua. These Chiriguans live in nice little huts, which they keep beautifully clean and tidy. They bathe and wash constantly; sowing a little maize, which forms their chief food, and drinking inordinately of chicha, an intoxicant prepared in a disgusting way from maize. The Chiriguan bores his nether lip, wearing between it and his chin a button "tembeta," set with small beads cut out of stone. Boys begin wearing these when arrived at the age of puberty; at first they have only a small plug of wood, which most of them afterwards exchange for a metal button. Their sole independent art is limited to pottery. The pots are adorned with rather pretty ornaments of curved lines, which, however, do not offer much variation. They bury their dead in giant pots, as is usual with the Guarani people. These pots they bury in a corner of the rancho, which—at any rate, on the death of the master of the house—is set on fire. This manner of burial will, of course, soon disappear. I have myself dug up a double pot containing a skeleton, which it was stated had been buried in 1899. It cannot have been much longer ago, since in the spring of 1902 there was a perceptible smell. These Indians generally live as monogamists, though the chiefs, at any rate, take a new wife when the first loses the charms of youth. They are said to believe in a life hereafter—in fact, a very jolly life, with plenty of drink and women galore.

On March 13 we arrived at the Aguayrenda mission station, and on the 15th instant set up our camp at Tatarenda. This place is within a woody region forming a transition from the damp highland forest and the dry wood of the Chaco. The rainy season was now almost at an end, both animal and vegetable life being most abundant. At Tatarenda I made several experiments with luminous insects. They are very numerous hereabouts, and show great divergence in luminosity. For instance, there was an elateride caterpillar (previously observed by Holmberg in north-eastern Argentina), the head emitting a red light, while each segment was provided with two spots which, like the final segment, emitted a green light. The red glow was constant, the green interrupted at intervals. What possible advantage could be derived by the caterpillars from this light? They have no gain in enticing other individuals to their side; nor can the purpose be that of frightening their enemies, as the light would not then be extinguished so soon as the caterpillar is disturbed.

Not far from our camp, a tribe of itinerant Chorote Indians had encamped on the borders of a palm wood. We, and more especially von Rosen, soon became good friends. They came to our camp, brought all sorts of animals for our collections, offered us their ornaments, etc. It is wonderful how well these Indians are acquainted with their primeval forest, with its innumerable insects. I wished to get several specimens of a luminous elateride caterpillar whose manner of glowing was interesting, evening after evening searching for it, but in vain. Finally, I

showed a couple of Indians the larvæ, and after a short time they came back with many specimens. I did exactly the same at Quinta, so as to obtain a fly-caterpillar, some Mataco Indians being my helpers there.

The Chorotes are a very primitive race living on the south side of Rio Pilcomayo, like other itinerant Indians of the Chaco, subsisting on fish and wild fruit. Their huts are small, round, and thatched with palm leaves, the domestic utensils consisting of a few coarse earthenware pots and mussel-shells. They weave cloth of the bast of a bromelia, the so-called Chaguar (*Bromelia serra*); adorn themselves with conch shells, beads, and feathers, and wear large pieces of wood set in their ears. They obtain fire with wooden sticks. Their weapons are bows and arrows. The arrow-heads are of hard wood, being frequently barbed. Though the Chiriguans in the mountain valleys have access to stone, which is not the case with these Indians of Chaco, their arrow-heads are of wood. In the pre-Columbian dwelling-places at Quinta, on the borders of the Argentine Chaco, you never find an arrow-head or even a stone which seems to have been used as such, whereas in the Puna and in Tarija, von Rosen collected several thousand stone arrow-heads and, at the dwelling-places, the ground was strewn with chips, which were evidently caused by their manufacture. Probably the prehistoric Indians at Quinta had arrow-heads of wood.

At Tatarenda I made various experiments with a myriapod developing cyanogen. These insects are already known to entomologists. The gas produced by a few specimens of this myriapod killed a frog in little more than ten minutes, insects dying in far less time.

From Tatarenda we rode on to Crevaux, on the Rio Pilcomayo. The Bolivian Government placed an officer and eight men at our disposal for this excursion, of which force, however, we only partly availed ourselves. The road from Tatarenda to Crevaux takes two days and a half, and runs through thickets. The Bolivian Government has built a small fort at Crevaux, and stationed a slight force there as protection to the settlers against the Indians. The vegetation around Crevaux consists of a dry thicket without any other vegetation beneath it, a wood in which it is fatal to lose one's way, since it is very difficult to penetrate, and there is no water, even a few days after a rainfall. The ground consists of fine dust, and at Crevaux there is not a stone or a grain of sand.

The most important rivers flowing into the Chaco are the Pilcomayo and the Bermejo, which, though greatly reduced in size, reach the Rio Paraguay. Other streams and rivers lose themselves in the Chaco. Close to the mountains, they deposit stones and gravel, and simply carry fine silt out into the Chaco. A river like the Pilcomayo has no determined course, but in the Chaco divides and distributes itself in swamps at random. During the rainy period these rivers, having an abundance of water, deposit vast masses of sludge; during the dry

season, the quantity of water being greatly reduced, the sludge deposited by the river turns into dust, which, blown about by the wind, is spread far and wide.

The loose soil of the Chaco seems to me, as previously stated, to be formed of sludge deposited by the rivers and afterwards transported by the wind. It is scarcely probable that sediments carried through the air from distant parts should form any considerable portion of these deposits. Sections made through the earth strata of the Chaco prove it to be loose, characteristic, unsifted, porous dust, full of the shells of numerous land-molluscs.

In order to comprehend how enormous masses of sludge can be carried along by the rivers, we must duly consider the rainfall. Whereas in the north of Europe it is only during spring that the streams transport any large mass of solid material, the rivers of South America are thick with sludge during the entire period of the rainy season. Storms are also far more violent in these regions than in the north of Europe. On the route to Quinta from Salta, the Rio San Francisco is crossed. I have traversed it when there was but little water; this same river, however, annually claims some victim among those who ford it at flood-tide. A rider, wishing to cross the river after rain, perished in the attempt, and all that was ever found of horse, rider, or saddle was a saddle-bag, everything else had completely vanished. The great difference in elevation also favours this accumulation of silt in the Chaco. The rivers come from a height of several thousand feet, with an exceedingly abrupt fall into the Chaco, where the further flow has a very slight descent.

At Crevaux we had some contact with the Tobas and Matacos (*Noténes*)—tribes whose manner of life and belongings resemble those of the Chorotes, who are, however, more given to gaudy trinkets than the Matacos, though far more cleanly and of brighter disposition.

With our excursion to Crevaux the programme laid down for the expedition was finally accomplished. From Crevaux we wended our way back to Tatarenda, and followed the spur of the Cordilleras as far as Bermejo. On approaching the sierra the route lies through high-stemmed primeval forests; farther on the low thickset dry wood appears that is typical of the Chaco. During our march we obtained some Indian skeletons. On May 13 we reached the Esperanza sugar mills, arriving at Salta on May 17, whence we returned *viâ* Buenos Ayres to Sweden, where we landed on June 27, 1902.

Briefly stated, the chief results of the expedition were as follows:—

Collections of fossil mammals from Tarija.

Botanical, as also zoological studies and collections made in a district of very varied nature, collections which we trust will be of use, not only for purely systematic studies, but also those in phytogeography and zoögeography.

Ethnographics from the following Indian tribes: Omaguacas, Chiriguanos, Matacos, Chorotes, and Tobas.

The discovery on the borders of the Chaco of dwellings and burial-places belonging to a pre-Columbian culture, which, even if not of very great importance, is of interest, since it appears distinct from any previously known from these regions: showing, moreover, many individual peculiarities, evidently derived from inhabitants of the plains.

Excavations of ancient dwelling-places at Puna de Jujuy and the Tarija valley, and studies connected therewith as regards the limits of the power of the Incas towards the south-east.

A collection of skulls and skeletons both from a period of culture long since past, as also from living Indian tribes. This should provide material for comparative studies of scientific interest.

Furthermore, let me mention the indigitation of pre-Columbian salt-mining in Salina grande in Puna de Jujuy, an industry which has probably been an important factor in the trading between the various peoples.

Finally, as a curiosity, there is the pre-Columbian place of sacrifice, or signalling station, on the summit of Nevado de Chañi, 20,000 feet above sea-level.

ANTARCTICA.'

By HUGH ROBERT MILL, D.Sc., LL.D.

ANTARCTICA is the hypothetical Antarctic continent, and Mr. Balch seems to have set out in his task of discovering its discoverer with the determination that this discoverer must be an American. The motive is patriotic rather than scientific, and the work altogether savours of special pleading, in the course of which the evidence is not always quite fairly interpreted, and is sometimes not clearly understood. Apart altogether from motive and interpretation, the work which has gone to the making of this book has distinct value as a piece of bibliographical research, and the book reflects the greatest credit on the enthusiasm and perseverance of the author. In noticing his arguments, we wish at the outset to make it clear that we cannot allow the first premise, viz. that the existence of the Antarctic continent as a geographical unit has been demonstrated, and therefore we think that the claims of people of any nationality are at present of minor importance.

* 'Antarctica.' By Edwin Swift Balch. Philadelphia: Press of Allen, Lane & Scott 1902.

We do not consider that the magnificent demonstration afforded by Cook and Bellingshausen that the fabled Antarctic continent was a myth was less brilliant as a geographical achievement than if one or other of them had proved that continental land lay within the Antarctic circle. Since Bellingshausen was unquestionably the first navigator to discover land in the Antarctic regions, strictly so called, the credit of the first discovery rests with Russia, for the same reason that the credit of the discovery of America rests with Spain. If an American could be shown to have seen Antarctic land before Bellingshausen, we should welcome the fact and praise the feat quite as warmly as if the hero were a British subject. Mr. Balch surely does not need to be assured that no British geographer would dream of withholding credit from any explorer on the ground of his nationality, least of all if that nationality were American.

As regards nomenclature, Mr. Balch uses the word "Antarctica" to express the mass or masses of land in the neighbourhood of the south pole, as first employed by Mr. J. G. Bartholomew. He uses the expression "the Antarctic" to include, in addition, the sub-antarctic islands, even going as far north as Bouvet island and Kerguelen. He criticizes the subdivision of the Antarctic area into quadrants by Sir Clements Markham, but does not show any reason for supposing that the use and nomenclature of these quadrants was more than a temporary expedient to assist contemporary exploration, so that this point need not be entered into.

Mr. Balch goes very fully into the beginnings of speculation and exploration as to the Antarctic regions, citing his authorities with much care. On the vexed question of the land found by Vespucci, supposed to be in 52° S., he considers that this land was South Georgia. A vast amount of labour is given to a discussion of the charting of the southern extremity of South America from Ruysch onward; but the real interest of the book begins with the advent of Dirk Gerritz. Following Ruge and Wichmann, it is, of course, impossible to support the claim of this Dutch sailor to have discovered the South Shetlands, or to justify the use of his name to designate that region. But Mr. Balch has seen in the Royal Archives at the Hague the manuscript of instructions for the voyage of the Nassau fleet in 1623–26, containing depositions of two members of the ill-fated expedition of the "five ships," both of whom were shipmates with Dirk Gerritz on the *Blijde Bootschap*. These are cited in Dutch and English. Jacob Dircxz states definitely that that unhappy vessel was driven south only to 56° S. Laurens Claess, after the loss of his ship, served with the Spanish admiral Don Gabriel de Castiglio on the coast of Chile, and declares that in 1603 he went to 64° S., "where they had much snow," but made no mention of land. As Wichmann pointed out when he discovered the document, this is doubtless the origin of the vague story which attached itself

to the name of Dirk Gerritz; but Mr. Balch keeps to the opinion that some one had seen mountainous land in 60° S. at the beginning of the seventeenth century.

On page 72, after a brief sketch of Cook's epoch-making second voyage, our author states, ". . . Antarctica was not discovered, a fact which would seem to rank the voyage of Cook as of much less importance than the voyage of Wilkes." If such extraordinary reasoning were to be allowed, one might say far more justly of the first transatlantic voyage, ". . . North America was not discovered, a fact which would seem to rank the voyage of Columbus as of much less importance than the voyage of Cabot."

In dealing with events subsequent to the voyage of Cook, Mr. Balch does not refer to the very extensive sealing trade which attracted a great number of British sealers to South Georgia before American competition began; but he quite rightly devotes a considerable amount of space to the doings of the American sealers from 1800 onwards, because, although their British competitors were probably always the more numerous, the Americans were the more communicative, and possibly the more prosperous.

Captain Fanning's story of the meeting of his companion Captain Nathaniel B. Palmer with Bollingshausen is one of the most picturesque pieces of that fine old sailor's remarkably picturesque book. Mr. Balch points out quite correctly that M. Arçtowski states that the meeting is also referred to by Bellingshausen. So it is, but Fanning's details are not confirmed. Bellingshausen only refers to the statistics of sealing given to him by Palmer. He could not have accepted Palmer's offer to pilot him into Yankee harbour in Deception island, for his chart of the South Shetlands shows that island without any internal harbour; that he had seen it from some distance is, however, made clear by the fact that a part of the coast is dotted in—no doubt the break in the crater-wall which forms the entrance to Yankee harbour. Bellingshausen called Deception island Tiele island, as a compliment to the Russian consul-general at Sydney, who had told him of the discovery of the South Shetlands. Mr. Balch accepts Fanning's statement that Bellingshausen named the land reported by Palmer south of the South Shetlands Palmer Land on the spot, and "by this name it is recorded on the recent Russian and English charts and maps which have been published since the return of these ships." Fanning's book was published in 1833, only two years after the appearance of Bellingshausen's book and atlas, in neither of which is Palmer's name given to any land, nor is the existence of any land between the South Shetlands and Alexander Land referred to in any way. It is obvious that either Bellingshausen suppressed most important facts, or that Fanning gave an exaggerated report of the interview with Palmer. In any case, Bellingshausen can hardly be cited in corroboration of Fanning's story

Fanning's services to Antarctic exploration were none the less of great importance, and Mr. Balch rightly claims for him and Powell the credit which is their due. Powell's chart of the South Shetlands, published in London in 1822, and reproduced in the book, is probably the first on which the name of Palmer Land appears, and the name was apparently given by Powell, not by Bellingshausen.

Morrell's book of travels is, we doubt, taken too seriously by Mr. Balch. We know no romance of the sea that is more amusing reading on account of the highly imaginative atmosphere in which the boastful mariner lived and moved. Probably enough he did make a voyage in high latitudes; if he sailed westward from south of Kerguelen, he might conceivably have followed the particular track with which his name is associated, but as evidence in any question of priority of discovery we consider Morrell's book to be absolutely worthless. Reynold's statement as to the high latitudes made by American sealers on the coast of Graham Land before 1828 is more satisfactory, but there are no particulars to give it the status of positive evidence.

Mr. Balch allows that "there appears to be no doubt that Balleny had a glimpse of the mainland of East Antarctica," yet he claims for Wilkes the credit of *first discovery*. The matter is unimportant, as Wilkes knew nothing of Balleny, and had written orders from home to explore that part of the Antarctic region in which he discovered land a day or so before it was also discovered in the same place by Dumont D'Urville. It may be that Wilkes has not always received due credit in this country. His courage in conducting a dangerous voyage with utterly inadequate ships and equipment deserves high praise. Giving Wilkes full credit for sighting points of land behind a long ice-barrier, and allowing that he called that land the Antarctic continent, we cannot see that he either proved that continent to exist or was the discoverer of it. It might be a chain of islands locked up by ice, and, if sighting points of that chain constitutes discovery, Bellingshausen and Balleny must come first. Ross proved that there is a vast extent of very high land south of the Antarctic circle, but the evidence that it is in the geological sense "continental" was first furnished by Sir John Murray, based on the discussion of the sediments collected by the *Challenger*, and since strengthened by the rock specimens obtained by other expeditions. In the geographical sense the Antarctic continent has not yet been discovered, unless indeed the *Discovery* and the *Gauss* have done so in the present century.

Mr. Balch, we fear, overestimates the importance of a traveller's assertions or beliefs, and underestimates the amount of proof required to substantiate them. When he says that "Bouvet and Kerguelen were disbelieved in and sneered at, nevertheless their discoveries have stood he test of subsequent exploration," he is only half right. Subsequent exploration showed merely that they had seen land; their own "dis-

covery" in each case was the Antarctic continent, and poor Kerguelen was himself the unhappy discoverer of his own mistake.

Mr. Balch is unjust to the memory of Sir James Clark Ross, though the latter may have been unduly hard on Wilkes in discrediting his discoveries. We feel sure that Ross was not aware of Wilkes's orders dated 1838 at the time he wrote of the American and French expeditions, "that the commanders of each of those great national undertakings should have selected the very place for penetrating to the southward, for the exploration of which they were well aware, at the time, that the expedition under my command was expressly preparing, and thereby forestalling our purposes, did certainly greatly surprise me." But Mr. Balch is not aware that D'Urville had no orders for his second Antarctic voyages, but set out avowedly with the object of forestalling Ross and securing the honour for France. He had a perfect right to do so; but the knowledge of the fact that he had acted in this way is sufficient foundation for an expression of irritation. The judgment quoted by Mr. Balch as passed on Ross by Dr. J. W. Gregory, "But Ross's range of interest was narrow; he did not land on the mainland he discovered, and would not let his doctor, McCormick, . . ." also rests, we believe, on imperfect information. Ross's interests were perhaps too wide, for he was an enthusiastic natural history collector as well as an accomplished magnetician and an able commander. It was his duty to think first of the safety of his ships, and the incident as to forbidding the landing of Dr. McCormick assumes a different complexion when it is known that by the rules of the service one medical officer must always be on board a man-of-war, and that on the occasion when Dr. McCormick begged in vain to be allowed to land (as stated in his own book, vol. i. p. 162), it was Dr. Hooker's turn to go ashore. Science lost nothing on that occasion by Ross's refusal to alter the equitable arrangement for the doctors to land alternately.

Mr. Balch has done a patriotic service, and also a service to science, in setting out the real achievements of Charles Wilkes, and he has succeeded in bringing together a large number of references to Antarctic literature, some of which did not appear in the hastily compiled bibliography of the 'Antarctic Manual.' He has also corrected an error in that bibliography, due, by the way, to a transcript without verification from an American journal, and for this we are grateful.

THE LAKES OF THE BALKAN PENINSULA.*

By Dr. KARL PEUCKER, Vienna.

In the atlas of the lakes of the Balkan peninsula, just published, Prof. Cvijić has filled a distinct gap in our knowledge of the lakes of Europe. The atlas forms the cartographic section of his great lake studies, of which the literary part will appear in the course of this year. Some of the main results of his researches into the forms of lake-basins and their origin have already been communicated to the *Journal*, and provisional bathymetrical maps have been published of the three largest of the ten actual lakes mapped in the atlas (the other lake-basins represented are marshes). The atlas contains the final maps, on the scales of 1 : 100,000 and 1 : 75,000, with full detail and distinctive colouring. Following the example of the atlases of the Austrian lakes and the maps of the English lakes which have appeared in the *Journal*, both the lakes and the country surrounding them are contoured and coloured in appropriate tints. The map characteristics also disclose an abundance of new facts. Places covered with reeds, steep rock slopes, and more particularly the remains of ancient shore-lines, are clearly indicated. A special map, worked out in admirable detail, shows the neogene extension of the lakes of the peninsula. The present lakes are clearly relics of the large and deep lakes of the beginning of the Tertiary period, surviving from the general drying up of the region. Only the Ohrid and Scutari lakes, as laid down from the excellent surveys of the Austrian officers, show the original forms in their present outline. The detailed new surveys of the Servian savant have revealed important and hitherto unknown features in the western and south-eastern parts of Lake Prespa; the form of the Kastoria lake, and of the two lakes of the Chalcidice peninsula, and the position and form of the island of Scutari, have been considerably modified. The soundings, given below in Table B, although not as numerous as those taken in the lakes of Central and Western Europe, are quite sufficient to indicate fully the relief of the basins; the network of soundings is open where the bottom is uniform, and close where it is irregular. Only by this method was it possible to find the deep holes in the bed of the Scutari lake already mentioned, or a sub-lacustrine river-bed in the Ohrid lake. In places the lake-bed is represented by isobaths 10 metres apart; in others the vertical intervals are 5 metres and 3 metres; and in shallow lakes, or in regions of complicated form, 1 metre, coloured in four shades of blue. The distribution of temperature in the water of the Ostrovo lake is shown on a special sheet by means of curves. The "limnometric values" for the different lakes, given in the tables appended, are brought up to date by the addition of some republished figures, and the numbers are here converted to English measures. The last two sheets of the atlas give a special graphic representation of the numerical values, worked out by the writer of this article, in which the relations of form and size of the lake surfaces and basins are clearly depicted.

In the tables the lakes are arranged in order of size, beginning with the smallest, the Yannina lake in Epirus, with an area of 18·8 square kilometres, or 7·3 square miles, and ending with the Scutari lake, with 356 square kilometres, or 137 6 square miles—a range equivalent to the distance from Loch Rannoch in Scotland, or the Walchensee in the Bavarian Alps, to Lough Neagh in Ireland, or the Lake of Garda in the Italian Alps. The Yannina lake is the smallest of the ten, but the Kastoria lake is the shortest. The Scutari lake is both the largest

* 'Atlas der Seen von Makedonien, Altserbien und Epirus.' Von Jovan Cvijić, Prof. a.d. Kgl. Universität in Belgrad. Ten sheets in portfolio. Belgrad, 1903.

and longest; the second in size, Lake Prespa, has the greatest mean breadth. The tabular values for length and breadth furnish a new definition of the "length" of a lake; it appears for the first time as the shortest line measured along the water surface between the two most distant points of the shore. This line admits of precise construction, and has a distinct significance in relation to commercial geography as the shortest line of communication between these two points. In lakes having a curved outline—valley lakes, etc.—the "length" is a broken line, compound from tangents on the curves of the shore; otherwise it is a straight line identical with the "air line." The limnometric sheets of the atlas also furnish a new and precise idea for the determination of "articulation" (*Gliederung*), a conception which has been the subject of endless discussion in German geographical literature since Karl Ritter. According to this the Dojran lake, east of the Vardar valley, is the least articulated; it has only five inlets, forming together about 4 per cent. of the total area. The Beshik lake is the most highly articulated; its exploration, and that of the sister lake, Lake Ajvasil, has been very fully carried out by Jankovic, a pupil of Prof. Cvijić; we find that its seven inlets make up 48 per cent. of the total area, or nearly one half. On the other hand, the Ohrid, Ostrovo, Prespa, and Scutari lakes have a greater number of articulated members, but the total area of these members is relatively less; the inlets and bays in the Scutari lake include thirteen of the first order, eleven of the second, and nine of the third, but together they make up only 25 per cent. of the whole area. Its thirty-four islands, which, as in all these lakes, lie close to the shores, make up only 0·4 per cent. of the area. The bays formed by submerged river-valleys in the north-west and north-east of this interesting Montenegro-Albanian lake cut off large peninsulas from the surrounding land, which is thus also highly articulated by no less than forty peninsulas of the three first orders, compared with five in the Dojran lake. Of the five larger lakes only the Beshik and Ohrid have no islands, and of the five smaller only the Tannina and Malo lakes have any; in contrast to the Scutari lake, all have only one or two. The Prespa lake has absolutely the largest, the Malo lake relatively the largest, island area.

The soundings taken during the summer months of the years 1899 to 1901 have shown that the Malo lake is the shallowest, the Ohrid lake the deepest; the latter, with a maximum depth of 938 feet, is actually one of the deepest lakes in Europe, although not in relation to its size. Its volume nearly equals that of the Lake of Constance, more than seven times that of the Prespa lake, which drains into it subterraneously, and twenty-three times that of the Scutari lake. The other lakes, with the exception of the Ostrovo, are amongst the shallowest known. The Scutari lake is not more than 20 to 26 feet deep in the centre, and in the holes, which are of insignificant area compared to the total, the depth only attains a maximum of 144 feet ("Oko" of Raduš). The shallowness is also apparent from the slope-angles of the bottom, the values being mostly under 1°. The Ostrovo and Ohrid lakes are, on the whole, not so level; the mean slope of the latter is the same as of the Lake of Constance. The last sheet of the atlas gives a graphic analysis of these slopes, from which one can form an opinion as to the relations between surface and slope at various depths. Angles and surfaces are strictly comparable in "hypsoclinographic surfaces," which is not the case with "hypsoclinographic curves" like those published for the lakes of Central Europe.

In contrast to the land surface, the water surface of lakes gives a surface mathematically parallel to the form of the ideal spherical earth. This spherical form of the lake surface is an important characteristic of the whole type of geographical form, and its importance becomes apparent even in lakes of medium size. In the Ajvasil lake, 7 miles in length, the margins of the opposite eastern and

western shores would lie hidden from one another were it not for well-known optical phenomena: a wall of water rises 8 feet above the straight line of the lake. This is an important limnological fact in the discussion of optical questions. It is only possible to see across the three smallest of the lakes dealt with here in all directions; in the three largest one cannot see from shore to shore in the broadest places. On the Ohrid the wall of water rises 10 feet, on the Scutari over 17 feet, on the Prespa 20 feet. Longitudinally the height is five to six times as great in these lakes, and on the Scutari lake the height is 100 feet. It follows that the share of the spherical segment in the total volume of water increases with the size of the lake; the height of the arc is a function of its area. In order to obtain trustworthy values, the irregularly bounded spherical segment of the lake surface must be replaced by a segment of equal area having a regular boundary.

The relation between the depth and area of a lake is a factor whose importance must not be underestimated in the discussion of questions relating to its origin. The relation of the volume of the spherical surface segment to the total volume of the basin is the same as that of the mean height of that segment to the mean depth. The former corresponds to the area, as has been seen; but we have now, for the first time, rational values for this important relation in the new conception of "relative depth," an expression analogous to the "relative height of mountains," and to the relation between mean breadth and length employed by British limnologists, and there called "relative breadth." It is interesting to note how, in the Scutari lake, the segment and volume nearly coincide (1·06), and how Lake Prespa, which is mostly over 60 feet deep, is relatively shallower than most of those of the ten lakes which are absolutely shallowest. It is not surprising that the deep Ohrid lake has a relative depth of over 43, but it is remarkable that this value is more than double those for the larger lakes of Constance and Geneva, nearly double that for the Lake of Neuchatel, and considerably greater (29 : 43) than that for the slightly larger Lake of Garda.

The last diagram in Cvijić's atlas gives an instructive picture of the elevation of the ten lakes, and of the general form of their basins. If one regards the chief point of contrast in the form of the basins as depending on whether the curvature from the margin at the deepest part is concave or convex, the formula given in one table, and already accepted by some limnologists, gives the criterion required according as the values are positive or negative. The positive values indicate a basin which contains more water than a hollow cone of the same basal area and depth, and the negative values one which contains less, and the numbers give the actual relation to the cone. The high positive values for Dojran and Ajvazil show that the general form of their basins is that of a truncated zone; those for Ohrid and Malo indicate a trough shape (hollow segment), and intermediate between these we have the Beshik. In the other lakes the bottom does not run down evenly, but shows varying depths. The slope is, on the whole, approximately a tangent to the general curve, the curvatures near the margins and in the depths neutralizing one another so far as the effect on the volume is concerned; thus the numerical values work out nearly to zero, the value for the theoretical hollow cone. This is especially the case in lakes Prespa and Kastoria, and also in Tannina and Ostrovo. The numbers below zero indicate lake-bottoms with convex slopes, where the incline in the depth is markedly steeper than round the margin, or is funnel-shaped; this form is prominent in the Scutari lake. While the trough-shaped Ajvasil holds two and a quarter times as much water as the simple conical form, the value (−0·67) for Scutari shows that that lake only holds one-third as much.

A.—SURFACE OF LAKE.*

Lake.	Scale of map.	Elevation of surface above the sea. (e)	Length. (l)	Breadth. miles. (b_m)	(b)	Mean diameter. (2r)	Reduced circumference. (c)	Area of lake. (a)	Mean breadth per cent. of length (relative breadth) $\frac{100\ b_m}{l}$ %	Islands. (i) A. of I (: number of I.). i_a (: i_n)
		feet.	miles.	mean	max.	miles.	miles.	square miles.		square miles.
Jannina	1:75,000	1640	5·0	1·46	1·9	3·0	23	7·3	29·3	0·8 (: 1)
Kastoria	1:100,000	2100	4·2	2·20	3·4	3·6	29	10·5	46·0	—
Dojran	,,	485	5·0	3·29	4·6	4·6	24	16·5	65·4	—
Ajvasil	,,	160	7·0	2·79	3·7	5·0	30	19·5	40·0	—
Malo †	,,	2990	10·9	1·84	3·8	5·1	45	20·0	16·9	0·36 (: 2)
Beshik	,,	160	14·7	1·80	2·9	5·8	55	26·5	12·2	0·8 (: 1)
Ostrovo	,,	1730	10·6	2·68	4·9	6·0	55	28·4	25·4	0·002 (: 1)
Ohrid ...	,,	2300	18·3	5·68	7·8	11·6	83	104·0	31·0	—
Prespa	,,	2980	18·3	6·06	11·0	11·9	104	111·0	33·1	0·4 (: 2)
Scutari	1:75,000	20	27·3	5·03	10·2	13·3	162	137·6	18·4	0·6 (: 34)

B.—BASIN OF LAKE.*

Lake.	Number of soundings.	Depth. feet. (D)	(D_m)	Volume. ($a . D_m = V$).	Height (H) of Segment (S) feet. (H_l)	(H_b)	(H)	Basin-form. $\left(\frac{3D_m - D}{D}\right)$	Relative depth. $\frac{S}{V}$ or $\frac{H_m}{2D_m}$	Mean slope.
		max.	mean.	milliards of cubic feet.	for length.	for max. breadth.	for mean diameter.			° ′
Jannina	82	34·5	14·1	2·83	4·1	0·6	1·5	+0·23	18·60	0 24
Kastoria	106	33·8	12·1	3·53	3·7	1·9	2·2	+0·08	11·20	0 18
Dojran	111	32·5	22·8	10·24	4·2	3·5	3·5	+1·06	12·60	0 16
Ajvasil	104	27·6	20·7	11·30	8·0	2·4	4·0	+1·24	10·30	0 14
Malo ...	80	25·3	11·5	6·36	11·0‡	2·4	4·3	+0·36	5·10	0 15
Beshik	140	73·2	45·3	33·55	36·0	1·4	5·7	+0·86	15·90	0 42
Ostrovo	198	202·0	87·0	68·87	18·4	4·0	6·0	+0·29	29·10	1 17
Ohrid	204	938·0	479·0	1391·60	56·0	10·0	22·2	+0·53	43·10	3 00
Prespa	250	178·0	60·7	187·44	52·0	20·0	23·6	+0·02	5·30	0 32
Scutari	240	144·0 (26)	15·7	60·00	100·0	17·4	29·5	−0·67	1·06	0 8

* Formula and construction of the new limnometric conceptions or determinations announced in this article, will be developed in H. Gravelius's 'Zeitschrift für Gewässerkunde,' Dresden.

† = small lake, wrongly called Ventrock-See.

‡ With 8·1 miles visible distance.

REVIEWS.

EUROPE.

Ireland.

'Ireland, Industrial and Agricultural.' Edited by William P. Coyne, Superintendent of Statistics and Intelligence Branch, Department of Agriculture and Technical Instruction for Ireland. Dublin. 1902.

The first edition of this encyclopædic work on the industrial resources and industrial occupations of Ireland was prepared for the Glasgow Exhibition of 1901, in which the sister island won exceptional renown by the general excellence of her exhibits. The present edition, the second, is a much-improved and greatly amplified version. Amongst the practically new sections there is one of great merit on the canals of Ireland, a factor which ought to be made to play an important part in the future development of the country. Although written in the first instance as a handbook to the Irish section of the Glasgow Exhibition, this book is very different, in its plan, its scope, and its treatment, from the majority of such works. It invites comparison with, as it was probably suggested by, those first-rate compilations, 'Norway' (1900) and 'Sveriges Land och Folk' (1900), both written for the last Paris Exhibition. All three books would be not incorrectly described by calling them special encyclopædias, the object being to give a fairly full account, under a diversity of headings, of the various phases of national activity, the constituent features of the country itself, and a fair summary of its economic condition and prospects. It should, however, be stated that the Irish book is less comprehensive in its scope than either of the other two with which we have compared it, in that it confines itself entirely to the agricultural and industrial factors, and only steps outside of those limits for the purpose of making clear the essential conditions which underlie those factors, and which have governed their growth and development. In fact, it may be said to be the first systematic attempt made since Sir Robert Kane wrote, in 1844, his 'Industrial Resources of Ireland,' to present anything approaching to a complete survey of the economic resources of the Emerald Isle. From the point of view of physical geography, the most important contribution to the volume is a paper on "The Topography and Geology of Ireland," by Mr. Grenville A. J. Cole, which, although couched in popular language, and covering a good deal of ground in a comparatively few pages, is distinguished by breadth of knowledge, a wide imaginative grasp of the subject, and remarkable lucidity of expression. One is able to gather from it a vivid conception of the way in which this outlying buttress of the primeval European continent came to be built up and assume the aspect it wears to-day. Ireland's woes began long antecedent to the advent, or even the presence, of man upon her shores. Although she was once richly endowed with coal-measures, the life-blood, so to speak, of modern industrialism, she was not allowed to retain them. The thrust and pressure of later geologic upheavals, aided by the influences of an unfriendly climate, swept them all away. Yet even this did not happen without some compensating advantages being vouchsafed to the island. She has her lovely lakes and crumpled hills of Killarney and the south; she has her rugged western and north-western coasts; she has her useful limestones, marbles, and granites, which, however, are not employed to anything like the extent their inherent beauty would suggest they ought to be; and she has her great inland plain, with its evergreen pastures, and its endless miles of bog—this last, too, not without its value should any of the numerous schemes for converting turf to industrial uses ever prove commercially successful.

Two of the most interesting features in the geography of Ireland are the fjords

of her western coasts and the peculiar formation and direction of her rivers. The former, as this book points out, exhibit several close resemblances and parallels with the west coast of Norway. A glance at the map will show that most of the rivers of Ireland flow to the south; though the upper courses of several of the largest, *e.g.* the Bandon, Lee, Blackwater, and Suir, run in a west-east direction. The primeval direction was to the south; but after the great foldings which took place subsequent to the Carboniferous era, the eastward-flowing affluents gained the ascendency, owing to the main rivers being unable to cut their way through the obstacles presented by the new anticlinal folds. This, however, was fully explained by Prof. Jukes as long ago as 1862. We have left ourselves barely space to allude in the briefest fashion to the astonishing progress which Ireland has made in agriculture, more particularly in dairying, during the last ten or a dozen years, an advance which is principally owing to the Hon. Horace Plunkett and his persuasive power in getting the Irish farmers to co-operate for their mutual advantage. The great things which have been already done for the awakening of Ireland agriculturally surely justify hopes of her ultimate regeneration, hopes which are now entertained by several thoughtful and far-seeing men, amongst them, we gladly note, such shrewd statesmen as Sir Wilfrid Laurier and President Rooseveldt.

French Hydrology.

'1er Congrès du Sud-Ouest Navigable tenu à Bordeaux les 12, 13 et 14 Juin 1902.' Compte Rendu des Travaux. Paris and Bordeaux: L. Mulo, etc. 1902.

For some time past a movement has been on foot in the south-west of France for the improvement of the system of inland navigation in that part of the country, where it has been exposed to a steady and progressive deterioration for many years. This movement—the need for which is shown by the almost entire neglect of south-western France in the Government schemes for the improvement of French waterways—led in September, 1900, to the foundation of an association at Bordeaux for the purpose of impressing on public opinion the need of decisive action in the matter, and this association, known first as the "Société de la Garonne Navigable," but subsequently widened in scope by the substitution for "Garonne" of "Sud-Ouest," has since been strengthened by the formation of branch associations with similar objects in many of the towns of the region affected. The first general congress of the several branches was held at Bordeaux last summer, and the proceedings of the meeting have been printed in the volume now before us, which extends to close on 500 pages.

These proceedings include several valuable papers dealing not only with the more technical question of the improvement of waterways, but with the wider subject of the general regularization of water-supply, and from this point of view the volume is an important contribution to physical geography. The evil to be combated is shown to arise from the increasingly irregular flow of water in the streams which descend from the Pyrenees, and are at times raging torrents, while at others they carry hardly any water at all. The activity of the erosion which takes place when the streams are full is such that, as shown by M. Bouquet de la Grye in a communication on the present state of the Gironde estuary, the river channels are blocked with sand and gravel, which, at ordinary level, the streams are quite unable to clear away. The readers of papers were unanimous in showing that the fault lies with the destruction of the natural vegetable covering of the soil in the mountains from which the rivers spring, owing to the increase in cultivation and pastoral industries, and that the only effectual remedy is the reforestation of the mountains, or the

clothing of their bare slopes with turf. In an elaborate paper on this branch of the subject, M. Fabre gave a forcible demonstration of the *rôle* of the forest in the regularization of the water-supply, quoting many instances from other countries of the evils which have resulted from a neglect to recognize this, and showing how the natural conditions in the south-west of France tend to exaggerate the struggle *pour et contre l'eau*. Unlike some recent writers, he still holds to the belief that an appreciable though small influence on the extent of precipitation is exercised by forests, though the importance of their action does not consist solely or chiefly in this. Other important papers deal with the conditions of precipitation on the northern versant of the Pyrenees, with the industries dependent on the waterways, and with various engineering projects for the extension and improvement of navigation, some of the last, as, *e.g.*, one for the impounding of the detritus by a huge trench carried across the bed of the river, being decidedly original. There are, in fact, few branches of the subject which are not fully discussed in the volume.

ASIA.

Russian Central Asia.

'Mountainous Bukhara.' Results of Three Summer Journeys in Central Asia in 1896, 1897, and 1899. V. I. Lipski. Part 2. Hissar, Peter the Great Range, Alai, 1897. St. Petersburg, 1902. (In Russian.)

This is the second part of the work reviewed on p. 64, and deals with the traveller's explorations in 1897. Having been hindered from exploring the Tupalang valley in 1896 by the rains and floods, M. Lipski returned to that part of the Hissar range in 1897, and travelled up the valleys of the Khovak and Chash, the former of which is the more important and must be considered the source of the Tupalang. At its head is the pass marked on maps Siya-kukh, but only known to the natives as the Panj-ab, the name applied to the upper course of the river. M. Lipski reached a height of 11,000 feet, but did not visit the pass itself, which seems to be little frequented, for no track was noticeable. The Chash pass is about 12,600 feet above sea-level. The upper basin of the Tupalang consists of rocky valleys often difficult of access, leading to snow-covered passes. The vegetation is poor, especially where it is exposed to the full glare of the sun, and the inhabitants are consequently far from prosperous. The Karatag valley was also visited, whence the Russian territory may be reached by the Mura pass, 13,302 feet high. It had been reported that the pass had been closed by avalanches, but M. Lipski found it by no means impracticable, though difficult. Proceeding to Darwaz, Lipski made a short excursion while his horses rested at Tabi-dara, crossing the Rabat pass, 11,165 feet, over which the natives of Darwaz bring corn from Karategin, and descending the Khumbou river to Kala-Khum, the capital of Darwaz. He then returned to Tabi-dara, and continued his journey to Peter the Great range, which he was particularly anxious to explore. Oshanin, who discovered the range in 1878, estimated its height at 20,000 to 25,000 feet. M. Lipski, however, believes that it is not more than 17,000 to 18,000 feet. The Hardan-i-Kaftar pass, by which he crossed the range from the valley of the Khingou, is 12,700 feet high, and the summits of the range appear to rise about 4000 feet above it. All the western part of these mountains consist of a sharply cut ridge with no summits rising much above the general level. Every valley and ravine contains a glacier. Chief among these are the Borolmaz, which descends from two peaks, the Borolmaz ("the wolf even has not been there") and Murtag ("icy" or "snowy mountain"), the Peter the Great glacier, and the Oshanin, all named by M. Lipski. They terminate at heights of 11,000 to 13,000

feet, and below them lie extensive moraines, which show that they were much longer formerly. Of the three streams which issue from the Borolmas glacier, one, the Kara-Shura, breaks southwards through the range and falls into the Khingou under the name of Shakli-su. A fine view of the range is obtained from the Tunguyuk-kul, a lake in the Surkab valley, 3½ to 4 miles long by 2½ to 3 wide, and lying at an altitude of 10,700 feet. M. Lipski returned to Samarkand across the Alai and by Margelan.

Tin Mining in the Malay Peninsula.

Octave J. A. Collet. 'L'Étain, Étude Minière et Politique sur les États Fédérés Malais. Brussels: Falk fils. [1902.]

The first title of this work would lead us to expect in it a study of tin and tin-mining in general. In reality the book, as the secondary title implies, is a monograph on the Federated Malay States and the mining industry practised in them—from which, it is true, no less than three-fifths of the total tin-supply of the world is derived. The first part consists of a clear summary of the geography and political history of the peninsula, a striking description being given of the recent development of the states under British protection. This development is, as is well known, almost entirely due to the progress made with the tin-mining industry of late years, and it is to an account of this that the larger part of the book is devoted. The broad features of the geology of the Malay peninsula, and the mode of occurrence of the tin deposits, are well described in the third chapter, while the manner of working the deposits, and the general economic position of the industry, are dealt with in the last three. At present the attention of the miners has been devoted almost entirely to the alluvial deposits in the valleys, but a more careful examination of the country is bound to reveal veins of tin ore *in situ*. Out of a total production of 75,000 odd tons in 1900, the Malay States were accountable for 42,000, and the whole Malay region (including Banka, Billiton, etc.) for 61,000. The production in England, Australia, and Bolivia reached only 4000, 3000, and a little under 7000 tons respectively, both the two former sources having shown a decided falling-off of late. The predominant position occupied by Malaysia is thus clearly shown. M. Collet considers that this region was the source of the tin-supply of the ancients, but does not solve the difficulty presented by the question of the transport of the ore in the small and frail vessels of those early times.

The Andamans and Nicobars.

'In the Andamans and Nicobars.' By C. Boden Kloss. John Murray.

This contribution to the accounts, more or less exhaustive, which have been published by travellers and by officials connected with the administration of the penal settlements at the Andamans and Nicobars since the annexation of those islands to the British Crown in 1858 and 1869 respectively, is a pleasantly written record of a successful cruise of some three months' duration (January to March, 1901) in these islands, "the main purpose of which was to obtain good representative collections (now in the National Museum, Washington, U.S.A.) of natural history and ethnological objects from the places visited. Special attention was given to the trapping of small mammals, which, comprising the least-known section of the island fauna, were the most interesting subject for investigation. Sixteen new varieties were obtained in the Andamans and Nicobars together, thus raising the known mammalian fauna of these islands from twenty-four to forty individuals, while the collections also included ten hitherto undescribed species of birds." Thus

is prefaced a work whose interest will be as great to the general as to the scientific reader, for Mr. Kloss brings to his task keen powers of observation and a freshness of style, while a certain dry humour is not absent from his pages. He has also evidently been at pains to inform himself of the works of many previous writers on the special objects of his cruise, as well as on the general geographical and ethnographical characteristics of the islands and their inhabitants; and by sundry well-chosen extracts from these records, places before his readers in a condensed form much information of great interest hitherto inaccessible to the general public. An excellent series of photographs taken by himself illustrates the text, while a chapter on the fauna of both groups of islands, together with useful appendices, a map, and a good index further enhance the value of the work.

Concerning the geology of the Andamans, Mr. Kloss writes, "It is curious that in the valley of the Irrawadi hot springs and other evidences of volcanic action occur in the same relative position to the Arakan hills as the two islands of Narkondam and Barren island occupy in respect to the Andamans. There seems little doubt that these two islands—now respectively extinct and quiescent—belong to the great line of volcanic disturbance that appears in Lower Burma and extends right through Sumatra and Java and the further islands of the Malay archipelago. Thus it would seem that the Andamans proper, possessed of no volcanoes themselves, lie just outside the line of activity, and, with the Nicobars, occupy the same position with regard to the volcanic track as do the chain of islands west of Sumatra." Had Mr. Kloss visited Narkondam as he did Barren island, he would have discovered that, though of volcanic origin, the island differs from its neighbour in possessing no volcano. It was, however, not until comparatively recent years that the long-prevalent belief in the existence of a volcano there was found to be incorrect.

Mr. Kloss points out that the great peculiarity of the Andaman flora is that no coconuts naturally propagated are found throughout the group, although the adjacent Cocos islands to the north and the Nicobar islands to the south are covered with them. In regard to this, it may be remarked that a considerable extent of the Andaman coast is protected by reefs, or consists of mangrove swamps or dense jungle where coconuts could not establish themselves; and it is doubtless mainly due to the special measures taken by the local authorities to protect the seedlings when planting them that, in the localities suited to their propagation, such as open sandy beaches, they have nowadays escaped destruction at the hands of the aborigines, as well as from pigs, rats, etc.

Of the aborigines Mr. Kloss truly remarks that "it would be impossible to find a race of purer descent, for ever since they peopled the islands in the Stone Age they have remained secluded from the outer world, and to this isolation is due the uniformity so marked in their physical and mental characteristics. In stature they are far below the average height; but, although they have been called dwarfs and pygmies, these words must not be understood to imply anything in the nature of a monstrosity. Their reputation for hideousness, like their poisoned arrows and cannibalism, has long been a fallacy, which, although widely popular, should now be exploded."

On the subject of the long-continued decadence of the native race, he writes, "The population of the islands has been computed from time to time—from the 6000 at the period of the founding of the settlement—in variously diminishing numbers down to the present day, when it is placed at about 1900. The case affords a striking example of the effect of contact between civilized and savage man, for only those tribes of the Andamanese that are still hostile, or who have little or no intercourse with the Government settlement, have preserved any

respectable number of individuals in their ranks. Of these, the Jarawas, although not distantly located from the settlement, receive all advances with inveterate implacability; while the Öngés of Little Andaman, who were until 1884 almost totally unvisited, are further off and enjoy an insular position."

As, however, only two of the twelve weeks passed in these groups were spent at the Andamans, Mr. Kloss has naturally more to say regarding the Nicobars and their inhabitants, based on the notes and observations made during the ten weeks that the yacht was cruising in the archipelago. His mode of spelling the names of certain of the islands is unfamiliar to those best acquainted with them, and is apparently copied from the excellent charts prepared in 1886–87 by Lieut.-Colonel G. Strahan, R.E., of the Survey of India.

Mr. Kloss has much of interest to relate of these islands and their scattered communities; he was fortunate in arriving during the celebration of certain memorial feasts, and also in meeting several members of the friendly branch of the remote inland tribe of Great Nicobar, known to the coast people as "Shom Peñ." ("Shom," in the dialect of the coast tribes, signifies "natives," and "Peñ" the tribal designation.)

It has long been held by the Government authorities—and Mr. Kloss is of the same opinion—that the members of the inland tribe, which is nowadays confined to the only large island of the archipelago, are descendants of the ancient aborigines of the group, who, "although everywhere else either exterminated or absorbed by settlers from outside, have in Great Nicobar found a refuge in the forest depths, and by long-standing hostility to the intruders, arising from some unknown cause, have preserved to a great extent their natural traits and existence, although somewhat degenerated, both on account of the less favourable circumstances in which they live, and of the interbreeding that the smallness of their numbers compels." As regards the coast inhabitants, Mr. Kloss adduces good grounds for the diversities of type noticeable among the natives of the various islands of the group.

In view of the fact that Mr. Kloss succeeded in amassing much detailed information on a great variety of subjects during his brief tour, it is somewhat surprising to find that he makes no reference to the remarkable robber-crab (*Birgus latro*), or to pythons and snakes, all of which are fairly numerous at most of the Nicobar islands. The late Dr. V. Ball, F.R.S., author of the valuable work entitled 'Jungle Life in India,' regarded the Nicobar robber-crab as an object of such interest that he decorated the cover of his book with a sketch of this peculiar crustacean.

But, in spite of certain errors and omissions which could hardly be avoided in observations made in the course of so brief a visit by one unacquainted with any of the dialects of the races concerning which he was writing, Mr. Kloss is to be heartily congratulated on his valuable contribution to our present knowledge of these islands and their inhabitants. It is to be hoped that this is not the only work we shall have from the pen of so competent an observer and explorer.

E. H. M.

AFRICA.

The Congo State.

'Civilization in Congoland: A Story of International Wrong-doing.' By H. R. Fox Bourne. London: P. S. King & Son. 1903.

Without discussing the merits of the controversy now raging with regard to the administration of the Congo State—a theme which hardly comes within the province of a Geographical Journal—we may safely say that this is a book which

must be read by all who wish to form an independent judgment on the questions under dispute, by candidly weighing the arguments brought forward on both sides. As the title of the book sufficiently indicates, Mr. Fox Bourne brings a serious indictment against the authorities of the State, holding that the whole methods of rule have been radically at fault, and have therefore had their natural outcome in the monstrous abuses which he considers fully substantiated by the evidence. In developing his thesis he goes back to the events which led up to the founding of the State, and traces its whole history downwards to the present day, so that, apart from the main theme of the volume, there is much that is likely to prove useful in the body of facts thus brought together, many of which are little known to the general public. There are chapters on early explorations and enterprises, on commercial developments, and on the relations subsisting between the Congo State and its neighbours; while an excellent map by Bartholomew is given at the end.

Present Relations in West Africa.

'Affairs of West Africa.' By Edmund D. Morel. Illustrations and Maps. Heinemann. 1902.

Under an elastic and even somewhat vague title, Mr. E. D. Morel, of the Liverpool Chamber of Commerce, has brought together a large amount of generally trustworthy information on the present political, racial, and economic relations in West Africa. With the rapid growth of the various European hinterlands the expression "West Africa" has acquired a very wide meaning, and is here understood to comprise all the British, French, German, and Belgian possessions ranging from the Atlantic seaboard inland to Lakes Chad and Tanganyika. Little is said about the German territory, but the problems associated with the social, religious, historical, and administrative conditions of all the other colonies are dealt with in a lucid and vigorous manner by a writer whose competency to discuss these complex matters is shown by previous contributions to the *Pall Mall Gazette*, the *Contemporary Review*, and several other periodicals under the familiar initials E.D.M. Mr. Morel speaks, in fact, *en pleine connaissance de cause*, as is made abundantly evident from the sections devoted to the British administration of the two Nigerias, to the French in West Sudan, to the monopolies ("concessions") in the Congo State, to the Fulani (Fulahs) and Hausas, *i.e.* the two politically or socially dominant native races north of the equator, to the rival Mohammedan and Christian propagandas, and generally to the natural products and trade prospects of the whole region. To these multifarious contents must be added a special chapter on the climate and sanitary conditions, contributed by Major Ronald Ross, the one universally recognized authority on these vitally important subjects.

It should be further stated that Mr. Morel is no mere compiler, but a close student and critical observer of passing events, whose trenchant remarks, scathing indictments where called for, and general inferences should arrest public attention, and be taken to heart by those more nearly concerned. While the trade of the French possessions is steadily increasing with a diminishing expenditure, the contrary is the case in their "moribund neighbour, Sierra Leone," where in recent years "the expenditure has increased by over 100 per cent. in the face of a decline in the producing power of the country."

A considerable space is devoted to the present state of affairs in the Congo State, regarding which our author shows himself to be particularly well informed. But the subject is scarcely suitable for discussion in this place, and it must suffice to say that the picture presented by him is deplorable. The chapters on Christian and Moslem rivalries in West and Central Sudan might also be studied with

advantage by philanthropists and enthusiasts. It is here plainly shown why Islam steadily advances, while Christianity fails to make any perceptible headway amongst the teeming Sudanese populations.

In future editions of this indispensable volume a proper set of maps should be supplied, and the index greatly enlarged. The proof-sheets will also need careful revision, such eye-sores as *ad literatim*, *irrespective* for *respective*, *was* for *were*, *whom* for *who*, *conquisitadores*, etc., being of far too frequent occurrence. It is also, I think, somewhat misleading to speak of De Béthencourt as having "conquered" the Canaries, that bold Norman rover having merely established himself at Lanzerote, and secured a footing in Fuerteventura, and perhaps one or two other points. But, generally speaking, the historical references are singularly correct, the very best authorities, such as Barth, Faidherbe, Binger, Verneau, Ellis, Clozel, Foureau, Goldie, Macgregor, Nachtigal, having in most cases been consulted.

A. H. Keane.

AMERICA.

The Colorado River.

'The Romance of the Colorado River.' By Frederick S. Dellenbaugh. New York and London: Putnam. 1902

The thrilling story of discovery in the Farther West of North America has yet to be told in a form suitable both to the general reader and the less advanced student of historical geography. A chapter in that story—and that perhaps the most fascinating of the whole—is, however, now supplied by Mr. Dellenbaugh, one of the members of Powell's Second Colorado Expedition of 1871–72, who gives in the work quoted above a comprehensive and most interesting account of the whole course of exploration in the Colorado region from 1540 onwards, while at the same time, as is but fitting, giving special prominence to the great expeditions by which the secrets of the Colorado cañons were for the first time revealed. The history is grouped by the author into four epochs, the first being that of the discovery by the Spanish conquistadores; the second the period of the "entradas" of the padres; the third that of the wanderings of the trappers; and the fourth the period of modern scientific exploration. The great names associated with Colorado discovery have of course been adequately dealt with in such works as Winship's 'Coronado Expedition,' Prof. Elliot Coues's edition of the Padre Garces' intrepid journey, and the like. But there are a host of minor names, especially in relation to the third period, which are almost unknown to the general public, but which all bore a part in the opening up of the region, and fittingly find a place in Mr. Dellenbaugh's narrative. Where necessary, the author enters into discussions on disputed points. Thus he holds that the point of the grand cañon reached by Cardenas—Coronado's lieutenant—was considerably lower than has been usually supposed, while he treats the whole story of the descent of the cañon by White in 1867, recorded by Dr. Parry,* as a myth. Among the modern expeditions and surveys—in addition to Powell's—which are dealt with in the volume, those of Derby (1850–51), Ives (1857), Wheeler (1871), Brown and Stanton (1889–90), may be specially mentioned, and among the trappers of the earlier period, Pattie and Jedediah Smith. The personal narrative of Powell's second expedition supplied by Mr. Dellenbaugh is in many ways more complete than any yet published, and in writing it the author has had the advantage of access to Prof. A. H. Thompson's

* Besides the account quoted by Mr. Dellenbaugh, a version of the supposed journey was given by Major Calhoun, a companion of Dr. Parry, in the first volume of Bates's 'Illustrated Travels.'

river-diary as a check to his own. It should be mentioned that chapter iii. gives an excellent account of the general character of the region and its inhabitants, while the work is profusely illustrated by photographs, and some striking paintings by the author are also reproduced.

The Martinique Eruptions.

'Mont Pelée and the Tragedy of Martinique.' By Angelo Heilprin. Philadelphia: J. B. Lippincott Company. 1903.

Already a considerable mass of literature has accumulated on the subject of the recent eruptions in the West Indies, and additions are being made to it daily. Prof. Heilprin's book is a very welcome contribution, as it contains a great deal of first-hand information which the author collected during two visits to Martinique, made expressly for the purpose of studying its celebrated volcano. He gives a full and clear summary of the events that preceded and led up to the great catastrophe of May 8, 1902, and though most of the facts have already been published, his *résumé* is interesting. The really novel part of the book begins with his first visit to Martinique shortly after the second eruption, which on May 20 completed the destruction of St. Pierre. Prof. Heilprin was the first to reach the actual summit of Montagne Pelée after the disaster, and, though he was baffled by the clouds which hang around the mountain-top, this only led him to return next day, when, for a few minutes, standing on the lip of the crater, he was able to get a glimpse of the abyss that lay beneath his feet.

In the end of August he returned to renew his investigations, and the chapters in which he describes his experiences during that visit make thrilling reading. From the eastern base of the mountain, which at that time was green and flourishing, he started again for the summit. The volcano was in a condition of great uproar. After his party had ascended to a considerable height, they were enveloped in dense cloud. In front of them the crater roared, and through the air blocks of rock were falling with a whistling noise, landing on the slopes with a dull hollow thud. With indomitable courage he pushed on, and a temporary rift in the clouds enabled him to see a vast column of ash-laden steam rising from the crater to a height of several miles. Finally, he had to beat a retreat, with the secret of Pelée's crater still unsolved.

That night an eruption broke out, and the deadly black cloud wiped out the villages of Morne Rouge and Ajoupa Bouillon, killing about 2000 of their inhabitants. Prof. Heilprin was in a mansion house on an estate close at hand, but escaped without injury, as apparently the cloud passed overhead. The description of his experiences during that day and night are of the greatest interest and scientific value.

A very brief chapter is given to the eruptions of the Soufrière in St. Vincent and one to the volcanic relations of the Caribbean chain. In another the author discusses fully the evidence that the Plinian eruption of Vesuvius, which destroyed the towns of Herculaneum and Pompeii, was of the same type as those of Montagne Pelée, and arrives at the conclusion that they were similar in their essential characters. The book contains comparatively little geological or mineralogical detail, and is evidently meant for the general reader. Its language is vigorous and picturesque, and it is well illustrated by reproductions from photographs, many of which were taken by the author or his companions. Its descriptions of the scenery of Martinique and the appearance of the devastated country are very vivid.

J. S. F.

MEXICO.

'Quer durch Mexico vom Atlantischen zum Stillen Ocean.' Von Dr. Wilhelm Schiess. Berlin: D. Reimer. 1902.

This work describes a journey through Mexico, made by Dr. Schiess in company with his brother, in the winter of 1899–1900. The author does not claim to be a scientific geographer, but, as some portions of his route led through parts of Mexico not generally visited by tourists, and as, moreover, he shows himself a capable observer, with a considerable power of grasping the characteristic features in the landscape, and of describing them so as to bring them clearly before the mind of his readers, the book is to be welcomed as supplying a good bird's-eye view of the country as well as of the mode of life of its people. Dr. Schiess both entered and left the country from the north, by way of New Orleans, proceeding by rail to the industrial centre of Torreon (recently developed at the expense of the neighbouring Lerdo, owing to its position as a meeting-point of five railways), and thence to Durango, whence the Sierra Madre was crossed to the Pacific port of Mazatlan. Steamer was taken thence to San Blas, which served as a starting-point for a journey from west to east through the more southern provinces. Here, among other excursions, an ascent was made of Popocatepetl, of the crater-wall of which an excellent photo is given. Dr. Schiess draws a vivid picture of the sun-scorched interior plateau on which Torreon is placed, though he remarks on the industrial development which even here has been fostered by the enlightened rule of President Diaz. But the part of the journey which presents the greatest interest is that by the still little-frequented mule-track across the Sierra Madre, during which the travellers often camped in the open with a night temperature as low as 18½° Fahr. Towards the east of the range such forests as ever existed have been almost entirely destroyed by the inveterate proclivities of the Spanish race in this direction, but in the more central and western parts the track leads through continuous forests, almost entirely of pines at the higher levels, but with oaks and other trees as the ground falls to the west. Few inhabitants were seen among the mountains, except at occasional ranches which were passed. Further south, on the way from San Blas to Mexico city, the beaten track was again left at various points, and the description of this section of the country is of considerable interest. The book is throughout well illustrated by photographs.

'Unknown Mexico.' By Carl Lumholtz. 2 vols. (illustrated). Macmillan. 1903.

Even before the publication of his graphic account of the Queensland aborigines ('Among Cannibals,' 1889), Mr. Lumholtz had made arrangements to prosecute his studies of primitive races in the still imperfectly explored regions of the Mexican plateau. The special attractions were the current reports of the cavemen surviving in the Western Sierra Madre, whose possible relations with the recently extinct cliff-dwellers of the Colorado cañons presented a fascinating subject to archæological students. Aided by liberal donations from Mr. Andrew Carnegie and other private sources, and from the American Museum of Natural History and Geographical Society of New York, Mr. Lumholtz was enabled to lead four separate expeditions to the western parts of the republic—one quite alone, the others in association with Mr. A. M. Stephen, Mr. C. V. Hartman, Dr. A. Hrdlicka, and several other distinguished naturalists. These expeditions were carried out at intervals between the years 1890 and 1898, and, as stated in the sub-title to the present work, constitute "a record of five years' exploration among the tribes of the Western Sierra Madre, in the Tierra Caliente [hot zone] of Tepic and Jalisco and among the Tarascos of Michoacan."

Most of the results have already appeared in the *Bulletin* of the American Geographical Society, in the *Proceedings* of the American Academy of Arts and Sciences, in this *Journal*, and in various other scientific periodicals. But the author was well advised to resume the whole subject in the consecutive narrative, enriched by numerous illustrations and maps, which, with a linguistic appendix and other useful added matter, forms the contents of these two handsomely equipped volumes.

As stated in the paper on his "Mexican Explorations" in the *Journal* for February, 1903, Mr. Lumholtz found that the Tarahumara cavemen were unconnected with the ancient cliff-dwellers of the South-Western United States, and a primary object of his researches was thus settled in a negative sense. But while this "connecting link" was snapped, others of wider significance were unexpectedly suggested, if not established. A great part of the second volume is devoted to the Huichol natives, who beyond all others are noted for the deep religious feeling which permeates the whole social system, and finds expression, so to say, in the symbolic spirit breathed into all their works, and animating all their surroundings. This is remarkable enough in the case of a people holding such a low cultural position as they do. But it is still more remarkable when we find their highly developed symbolism revealing many elements in common with the systems prevalent amongst the Pueblo Indians in the far north, and amongst the Aztecs of the Mexican valley. Such connecting links, long suspected by archæologists, are certainly strengthened by the investigations of Mr. Lumholtz, who further points out that some of the pottery unearthed by him in several districts "forms a transition from the culture of the pueblos of Arizona and New Mexico to that of the valley of Mexico, 1000 miles farther south" (vol. i. p. 94). Thus everything goes to confirm the growing opinion that the Aztec migrations were really from the north; while some even hazard the somewhat risky opinion that the seven caves of the shadowy Aztlan of the Nahua traditions may be the equally shadowy "seven cities of Cibola" which the early Spanish adventurers went in quest of and thought they had found amongst the *Casas Grandes* of the Tusayan pueblos. In any case, the range of these huge communal structures is much greater than is commonly supposed; and in the "Cave valley" of the state of Chihuahua Mr. Lumholtz explored the ruins of a great number—"not palaces, but simply dwellings, the whole village, which probably once housed 3000 to 4000 people, resembling in its general characteristics the pueblos in the south-west" [of the United States].

Here were recovered many beautiful jars and bowls, "far superior in quality and decoration to anything now made in Mexico" (i. p. 88). But even these were eclipsed by the earthenware objects brought to light in the Tepic district much farther south. Some of these, like those described by Mr. Holmes from Chiriqui (Costa Rica), had an exquisite polish resembling true glaze, and one superb vase, described and beautifully reproduced with all its wealth of colour (vol. ii. p. 296), will rank amongst the very finest specimens yet discovered in the New World. Well may the lucky finder exclaim that "not many specimens of such ware are to be seen in the museums of the world, and in some respects [the gold foil and rich greenish-blue sheen of the opalescent turkey plumage], none of them is comparable with the one here described" (p. 297).

The only fault to be found with these handsome volumes is their inconvenient weight, which is due to the unusually thick paper, needed perhaps for the effective reproduction of the numerous original illustrations.

A. H. KEANE.

POLAR.

The Italian Arctic Expedition, 1899–1900.

'La *Stella Polare* nel Mare Artico, 1899–1900.' Pp. 592. 'Osservazioni scientifiche eseguite durante la Spedizione polare di S.A.R. Luigi Amedeo di Savoia, Duca degli Abruzzi, 1899–1900.' Pp. 723. Milan: Hoepli. 1903.

'On the *Polar Star* in the Arctic Sea.' By H.R.H. Luigi Amedeo of Savoy, Duke of the Abruzzi. Translated by William Le Queux. Two vols. London: Hutchinson & Co. 1903.

In these two volumes recently published, a detailed account is given of the work of the Italian Arctic Expedition. The leader, the Duke of the Abruzzi, relates the incidents of the voyage to Prince Rudolf island, and the work of the party at their winter quarters at Teplitz bay. The voyage up the British channel was not accomplished without difficulty owing to the floating ice, and on the return voyage the vessel was imprisoned in the ice for fourteen days, and carried out to sea through De Bruyne sound. In Teplitz bay the *Stella Polare* was berthed amidst the land-ice, which, however, did not protect it from the pressure of the pack outside, and consequently the members of the expedition had to make a hasty retreat to the shore. Fortunately, it was found possible to repair the damage, and, with great labour and by the use of mines, to extricate the vessel in the following summer. In the autumn a sledge expedition was made round the island, which was found to be covered with an ice-cap, leaving only a few patches bare at Teplitz bay, Cape Säulen, and Cape Fligely. In 1874, when Payer travelled to Cape Fligely, the exposed ground seems to have been more extensive, and probably the ice-surface is now contracting again, for the loss from evaporation and melting is certainly greater than the gain from precipitation. Owing to the lowness of the island, there is little movement in the ice, and no calving of icebergs was witnessed.

The chief geographical discoveries of the expedition were reported in the *Journal*, vol. xviii. p. 282, where also a sketch was given of Captain Cagni's trying and exciting journey towards the pole, when he succeeded in reaching some 30 miles (86° 34′ N.) beyond Nansen's farthest; and allusion was made to the difficulty he experienced in regaining the island owing to the westerly drift of the ice and the leads that constantly opened and closed in the pack. How great were the obstacles he had to overcome may be learned from his own narrative. He was provided with kayaks, but they had been damaged on the journey, nor could they have been used amidst the shifting ice. Frequently Captain Cagni crossed a channel on a small piece of floe, taking with him a rope, by which his companions towed themselves across with the dogs and sledges on a larger block; and on one occasion a short voyage was made on an ice-block, the sails of the kayaks being hoisted to catch the wind. Dr. Cavalli, who commanded one of the parties which accompanied Captain Cagni part of the way, had also to contend with broken ice, but returned safely to Teplitz bay, whereas Lieut. Querini, though he started back earlier, when Prince Rudolf island was still in sight, was lost with his two companions.

The expedition was well provided with instruments of all kinds, and scientific work was carried on with regularity, the physical observations being under the supervision of Captain Cagni, while Dr. Cavalli took charge of the zoological, botanical, and mineralogical collections. Soundings were taken in Nightingale sound, where a maximum of 250 fathoms was obtained, and in the southern part of the British channel. At Teplitz bay hourly observations of the atmospheric pressure, temperature, and humidity were recorded, and in summer of the direction and velocity of the wind, all of which are given in tables in the scientific

report. The temperature in winter was not extreme for the latitude, the mean for the coldest month, February, being $-21°·4$ Fahr., while the lowest reading was $-45°·2$. The force of gravity was determined at Cape Flora and at Teplitz bay with the Sterneck pendulum apparatus. The result for Cape Flora was $g = 9·83088$ m. (32·25413 feet), and for Teplitz bay $g = 9·83240$ m. (32·25911 feet). Prof. Luigi Palazzo contributes a report on the magnetic observations, and Lieut. Alessio on the tidal measurements. The latter has also worked out the astronomical observations, and gives the following co-ordinates: Cape Flora, lat. 79° 56′ 47″ N. (Jackson, 79° 57′ 1″), long. $3^h\ 20^m\ 38^s$ E.; Teplitz bay, lat. 81° 47′ 36″·2, long. $3^h\ 52^m\ 16^s$ E.; Cape Fligely, lat. 81° 50′ 43″ N. Captain Cagni carried with him on his excursion northwards a mirror, instead of a mercurial horizon, on account of its smaller weight. He found it very difficult to level, and was not satisfied with the results. Lieut. Alessio believes that the observations taken from the natural horizon are reliable, and are not affected to any appreciable extent by variations in refraction. Nevertheless, it is to be regretted that a mercurial horizon was not used.

As already mentioned in the report in the *Journal* referred to above, animal life is not abundant on Prince Rudolf island. Eight species of birds were obtained, all of which have been observed further south, and eggs of the glaucous and ivory gulls, the dovekie, and the little auk were collected. Of the molluscs three are probably new species. The botanical collection was small, as might be expected in an island so far north and mostly covered with ice. One species only is new to science, a fungus which has been named by Prof. Mattirolo *Ascochyta Ducis Aprutii* after the leader of the expedition. The report also contains papers on the remains of reindeer found on Prince Rudolf island, measurements of nineteen specimens of polar cod and of a white whale, and of skulls of walruses and polar bears. The basalts and zeolites of the island are also fully described.

The general narrative abounds with incident, and the story as a whole is full of interest. The English translation is well done, and the handsome volumes are richly illustrated, and contain several maps, as do also the volumes on the scientific results.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

The Vegetation of the Earth.

'Die Vegetation der Erde.' Sammlung pflanzengeographischer Monographien herausgegeben von A. Engler und O. Drude. 6 vols. Leipzig: Engelmann. 1896–1902.

Geographical botany has, unfortunately, not been considered by most travellers in foreign—known or unknown—districts a subject worthy of careful study before leaving home. In spite of this, however, every large expedition does of course bring back a more or less bulky collection of dried or preserved plants, many of which, however, often only represent the more conspicuous flowering plants. The material thus brought back is named by experts, and lengthy lists of plants are drawn up by persons who may never have seen any of the plants they are examining in anything but a dried condition. The lists drawn up in this way are useful only for ascertaining the geographical distribution of the plant *species*. The geographical distribution of the plant *species* is, however, only one aspect of geographical botany. From a purely geographical point of view, it is, perhaps, the least important; from a purely botanical point of view, it is certainly the least interesting.

During the last few years botany has in all its branches been more and more influenced by the physiological aspect of questions and problems. In no branch has this gradual change been more noticeable than in geographical botany.

The plant *species* has been replaced in importance by the plant *form*. The plant form—in its internal and external structure—is an expression of the way in which the plant has adapted itself to certain external conditions. Given certain conditions prevailing equally over a large area, we find the plants—whatever the specific differences may be—assuming certain common external and internal structures. They are said to belong to the same plant form. An association of similar plant forms gives us a formation.

Roughly speaking, three chief formations may be distinguished—forest land, grass land, and desert land. Their presence in any region depends on the amount of water available for the plant, and may thus be directly due to the rainfall and atmospheric moisture. Forest land demands a large supply of water, desert land is satisfied with very little indeed. But we may, in the centre of a climatic forest formation, get a miniature desert, owing to some peculiarity in the nature of the soil. The latter may consist of a mass of porous rocky material, which causes all the water from rain and other sources to immediately soak away into the ground. The climatic forest is interrupted by a desert on account of certain conditions obtaining locally, which are strong enough to counteract the effect of the climate. Such a local desert would be called an edaphic formation.

The vegetation of any district is dependent in the first place, therefore, on climatic conditions, and in the second place on edaphic conditions.

The composition of the flora of any district—that is, the plant species and natural orders met with—depends almost entirely on the distribution of temperature. This is evident already when tracing the distribution of plant species, but becomes still more evident if we take genera or even natural orders. The present state of any flora composed of plant species is the result of historical development; that of the native vegetation, consisting of plant forms, is an expression of the climatic or edaphic conditions obtaining within recent times.

Forest land, grass land, and desert land are the three chief formations, but we get various intermediate types of vegetation, of which the savannas, intermediate between the forest and the grass land, are an example.

The geographical distribution of the plant species and the composition of the flora of any given district is a matter of study for the botanist, pure and simple. A knowledge of the distribution of plant-forms—that is, a knowledge of the composition and nature of the vegetation, as reflecting the influence of external conditions—is of the utmost importance, not only to the botanist, but also to the geographer. The internal and external structure of a plant, when taken into proper account, may indicate fairly well the present-day climatic and geological conditions of the district. But experience is necessary before the secrets thus held by the plants are disclosed. These secrets, furthermore, are nearly in all cases revealed only on the spot. Dried or preserved, many characteristic features of the plant-form are destroyed and disappear.

On the occasion of the meeting of the International Geographical Congress at Berlin in 1899, a most important paper on the history and development of geographical botany was published by Engler. Engler divides the study of plant-geography into three branches. Floristic geobotany determines the flora of a country, and maps out its districts, regions, and formations. Physiological geobotany explains the occurrence and nature of the plant-forms, which make up the vegetation, by studying the prevailing climatic and edaphic conditions. Developmental geobotany tries to explain the development and evolution of the plant world in terms of the history, geological and otherwise, of the district. He goes on to say that no one of these branches of plant-geography will be furthered materially by any worker who is not a botanist. This is certainly very true, for, generally speaking,

only a botanist can advance botanical science. But a certain amount of knowledge on the subject of physiological geobotany, or ecology, as it is sometimes called, will certainly be of great use to travellers, and thus the science of geography may be furthered. I need hardly mention here that even a small amount of practical acquaintance with this branch of botany would make it far easier for the traveller to describe scenery, in which plants usually play such a prominent part. By being trained to use certain definite and well-defined technical terms to describe the vegetation of any district, geographers would on their travels be able to give a far better idea of the regions they have visited than they are at present.

The object of these few general remarks is to call attention to a series of geobotanical monographs, which are now in course of publication under the joint editorship of Prof. A. Engler and Prof. Oscar Drude. It is called 'Die Vegetation der Erde.'

In their preface, the editors have stated what the object of this publication is. It is, in the first place, intended to collect all that is known about certain floristic districts, and publish the results in the form of a number of separate monographs. Each monograph will serve a twofold purpose. The material which has so far accumulated will be more readily available for consultation, and travellers will more readily than heretofore be able to ascertain what is known about any district and what still requires further elucidation. These monographs are, therefore, intended as guides both for the geographer and the botanist.

The whole work on the vegetation of the Earth will be published in three parts. The first part, which is to appear last, will deal with the general principles of geobotany, climatology, in its influence on plant distribution, the development of floras, and investigation of their phylogeny, based on geology and biology.

The second part, which also will be published later, will be devoted to the plant formations, more particularly those of Europe and the neighbouring countries. The various formations will be treated of in separate monographs.

The third part consists of a series of monographs, now in course of publication, descriptive of naturally well-defined floral districts. It is proposed to complete this part first, as far as Europe is concerned, before proceeding to parts one and two. In the case of extra-European districts, it may, however, be impossible to keep them quite separate. So far, six volumes have appeared, dealing respectively with the distribution and conditions of plant-life in the Iberian peninsula, the Carpathians, the Caucasus, Illyria, North and Central Germany. Each volume contains a full account of the plant species, plant forms, and plant formations met with in the particular district. The books and papers containing references to the latter are also listed. Illustrations and maps are made use of, but rather sparingly.

O. V. Darbishire.

THE MONTHLY RECORD.

THE SOCIETY.

The Antarctic Expedition.—Since our last number was published, some additional details respecting the Antarctic Expedition have come to hand, both through telegrams to the public press and through a despatch from Captain Colbeck, supplementing the original report of Captain Scott. From this it appears that the possibility still remains that the *Discovery*

may return this season, the final decision depending on the date of the breaking up of the ice. This would seem to imply that the ship was still fast in the ice when the *Morning* sailed homewards, but in this case it could hardly be expected to be released before the return of winter. Again, it is stated that, the present position being unsuited for more extended operations, new quarters would be sought and work continued; which does not fit in with the idea that freedom of movement was not open at the time. In any case, the supplies taken over from the *Morning*, together with such part of the original stores as had not been condemned, are said to be quite sufficient for another twelvemonth; but this does not, of course, obviate the necessity for the return south of the *Morning* next season, in case the *Discovery* does not make her way out before the final setting in of winter. As regards the work accomplished by the sledge-parties, it is now known that Captain Scott and his companions were out for ninety-four days, instead of, as was stated in the first telegram, going south 94 miles only. This correction, together with that already made in the *Journal* with regard to the highest latitude reached (82° 17′), removes the chief difficulty in the way of following the course of the expedition. Another sledge-expedition, not alluded to at first, was that of a party under Lieut. Armitage, which is now stated to have gone west for fifty-two days, reaching an altitude of 9000 feet, and at one point making a perilous descent by an ice-slide of 3000 feet. On the return, Lieut. Armitage fell into a crevasse, remaining suspended 30 feet below the surface, and was only saved by being roped to the rest of the party. This journey should be of special interest, as it must apparently have led at right angles to the coast, into the very heart of Victoria Land. The symptoms of scurvy, which made their appearance during the course of these expeditions, disappeared, Captain Colbeck says, after the return to the ship. Lieut. Shackleton was advised by the doctor to return, but all who stayed with the *Discovery* were in good health and spirits, and cheerfully volunteered to remain another season in case of need. Lieut. Mulock, who went out in the *Morning*, volunteered for service in the *Discovery* in the place of Lieut. Shackleton.

EUROPE.

Sand-hill Vegetation on the Lancashire Coast.—A large part of the Lancashire coast is, as is well known, fringed by drifted sand-hills, which attain an extension hardly surpassed on any of the British coasts. In spite of the sandy nature of the soil, the district has a fairly rich flora, and its waste places seem to offer unusual opportunities for the establishment of adventitious species. Four such, which seem to be gaining ground with more or less rapidity, are described by Mr. C. Bailey, from the neighbourhood of St. Anne's-on-the-Sea, near Blackpool, in the *Memoirs* of the Manchester Literary and Philosophical Society for December 15, 1902. The first is one of the North American evening primroses (*Œnothera biennis*, Linn.), which has been established on parts of this coast for seventy or eighty years, and is one of the earliest plants to grow upon newly disturbed ground.

Although a prey to constant plucking, owing to its conspicuous flowers, it continues to spread more and more. Another colonist is the *Sisymbrium pannonicum* (Jacq.), a crucifer from continental Europe and Western Asia, which also occurs about Preston. Mr. Bailey's observations show that in 1902 it occupied a larger area than in 1901, and is extending inland. A third alien, which, though apparently established some years, does not seem to have been previously reported from St. Anne's, is a dwarf form of the American ragweed, *Ambrosia artemisiæfolia* (a somewhat aberrant composite), regarded as a pernicious weed on the other side of the Atlantic. It grows at St. Anne's in patches several yards in diameter, monopolizing the rough hollows of the sand-hills almost to the exclusion of the native vegetation. Its rapid spread is occasioned by its habit of giving off underground runners or stolons, sometimes over 4 feet long, from which upright shoots spring at intervals. It is suggested that, as fowls were formerly kept in the locality, fruits of the *Ambrosia* may have been included in grain-sweepings from the docks, with which the fowls may have been fed. The fourth adventitious species is a vetch, a near ally of *Vicia cracca*, which appears to be still rare, and, though found in every European country but Great Britain, seems now for the first time recorded from this country.

The Geological History of the Site of Salzburg.—An interesting investigation into the geology of the region upon which the town of Salzburg stands, and the history of its present relief, has been made by Herr Hans Crammer, at the suggestion of Prof. Penck. The Mönchsberg and the Reinberg, which overlook the streets of the western parts of the town and its outskirts, are chiefly composed of the so-called "Salzburger Nagelfluh." As the result of their own researches, Wähner and Fugger have concluded that this conglomerate formation is of preglacial age, while Penck, in 'Die Alpen im Eiszeitalter,' maintains that it is of interglacial origin. A study of some recent excavations has enabled Herr Crammer to show that Penck's view is the correct one, and members of the "glacier" excursion at the forthcoming Geological Congress will have an opportunity of examining the new exposures. In both the Mönchsberg and the Reinberg the "Nagelfluh" shows regular bedding, with a sharp dip, the strata resting on a bed of sandstone, which in turn lies on a mass of boulders and pebbles. Penck and Crammer have shown, from internal evidences, that this last is a ground moraine, and that it is older than the "Nagelfluh" is proved, not only by its lower level, which Crammer has traced inwards for 26 feet, but by the entire absence of stones or pebbles from the "Nagelfluh" within it. Crammer interprets his facts as follows: A retreat of the Salzburg glacier of the ice period caused the formation of a lake behind the terminal moraine to the north, as Penck has shown, and into this lake flowed the glacier water, the present Salzach. At the mouth of the stream a delta naturally formed, with its typical structure of a smooth, sloping cone. The core of the cone consisted of the ground moraine of the retreating glacier; this was covered first by fine sand carried in suspension by the stream, and then, as the delta grew lake-wards and the stream became faster, larger pebbles and stones were deposited. The earlier covering consolidated, after the draining of the lake, into sandstone, the low-lying sandstone of the Salzburg hills, and the later into the "Nagelfluh." The Mönchsberg and Reinberg are parts of an old delta built out by the glacier stream in a lake which filled the Salzburg plain between two projections of the glacier. The destruction of the once continuous "Nagelfluh" sheet has been effected, according to Crammer, by the action of both water and ice, and the working of the latter may be traced both in gradual grinding or abrasion and its sudden outbursts, several features of much general importance in the study of questions concerning glacier-erosion being observable. But under the protection of older and harder rocks the "Nagel-

fluh" remained undisturbed; the strata of the Münchsberg dip towards the main dolomite of the Salzburg Festungsberg, and the Reinberg may owe its preservation to the same mass. On the outskirts of the town the "Nagelfluh" of the Hellbrunner hill joins the outcrop of a bed of the older "Gosaukonglomerat," and another relic of the old delta-covering is found in the "erosion shadow" of a hill of nummulite limestone.

The Development of the Vegetation of Central Germany.*—The author of this paper gives first his own views on the origin and development of the vegetation of to-day in Central Germany, and then criticizes very strongly the views held by Drude. He begins by discussing the early periods of the last ice age, when the country was covered with plants of an alpine and northern character, and but few representatives of the steppes of the preceding warm period were left. Of forest land there was little, but gradually, with the increase of warmth, *Picea excelsa* appeared, driving away *Pinus sylvestris*, *Betula pubescens*, *Larix europæa* and *Pinus cembra*, and itself giving way to *Fagus sylvatica*. The advance of the forest coincides with a retreat of the remaining plants of the coldest period. The increasingly warm climate with its heavy rainfall gradually, however, led to a period with a moister and colder climate. It is, however, impossible here to follow the author further in his very elaborate but comparatively short account of the series of changes in climate and vegetation which intervened between the last glacial period and the condition of things obtaining in Central Germany to-day, with its climate, typically continental, and its extensive forests. The author refers the reader to a series of his own publications, where the whole subject is dealt with more clearly than is possible in a short paper, more than half of which is made up of strong criticisms of the work done by other authors.

Zoological Research in the Adriatic.—An association for the advancement of scientific research in the Adriatic has been founded recently in Vienna. At the inaugural meeting, which was held in the university on March 24, the proceedings were opened by the Rector of the University of Vienna, Hofrath Gussenbauer, and after a speech by the president of the new association, Count Vetter von der Lilie, Prof. Berthold Hatschek delivered an address on "Marine Research." The work of the association, which will co-operate with the Government biological station at Trieste, will in the first instance consist in establishing and maintaining a marine aquarium at Trieste, and in fitting out a suitable steam-vessel for the scientific exploration of the northern part of the Adriatic.

Reafforestation in Italy.—A consular report on the trade of Naples dwells on the unsatisfactory condition of forest management in Italy at the present time. A forest law of 1877 empowered the withdrawal of 4,000,000 acres of forest land from reserve, as it was considered that a great quantity of land would thus be brought into cultivation. This proved to be the case, especially in the lower ground, and the result was that the forests of Italy were felled in a most reckless manner. It is now generally admitted that State aid must be called in if anything is to be done, and reafforestation undertaken. It is suggested that the cork tree would be the most profitable for the latter purpose. Apart from Italy, the cork production of the world is thus distributed:—

* 'Ueber die Entwicklungsgeschichte der gegenwaertigen phanerogamen Flora und Pflanzendecke Mitteldeutschlands.' By Aug. Schulz. Berichte der Deutschen Botan. Gesellschaft. Band xx. Berlin, 1902. 4°, pp. 54–81.

Country.	Area in acres.	Production (quintals of 220 lbs.).	Value of export
			£
Portugal	741,000	275,000	689,000
Spain	617,500	328,000	1,400,000
Algeria	694,070	88,000	288,000
France	176,800	60,000	320,000
Tunis	197,600	7,000	24,000

Italy has about the same area as Tunis under cork forest, but she exports to the value of about £36,000. The Calabrian forests have been almost entirely destroyed, the trees having been burnt for charcoal.

ASIA.

Surveys in China.—On the termination of the Chinese disturbances in 1901, an important expedition was organized under Lieut.-Colonel Manifold and Captain Hunter, who set out from Peking for Suchwan on September 20, 1901, with the object of exploring the routes to the upper Yangtse valley from the north-east. Colonel Manifold recently gave some account of the earlier part of the journey before the United Service Institution of India, in whose journal for January last the paper is printed. While entering but little into details respecting the actual survey work accomplished (though this was of considerable importance, as the routes were in part entirely new), the paper is of interest from the light which it throws on the condition of the country and the attitude of the people on the morrow of the occupation of Peking and parts of the neighbouring provinces by the allied powers. Colonel Manifold found that a correct knowledge of the events of 1900 and 1901 had extended far beyond the area actually affected by the operations, no attempt being made, as after former defeats, to deceive the populace as to the real issue of the fighting. Although it might have been supposed that the recent disturbances would have made travel in the far interior less safe than usual, this was by no means the case, the officials feeling that they would be held responsible for the safety of foreigners, to whom, and especially to missionaries, an unusual amount of deference was shown. A widespread desire for the adoption of European methods and ideas, as the only means of maintaining a stand against foreign aggression, was also observable. From Peking the route of the Peking-Hankow railway was at first followed, and Colonel Manifold formed a high opinion as to the future commercial importance of the line, which, with its continuation to Canton, will tap the commerce of all the main waterways of China. The nations controlling this great highway must, he thinks, exercise a very great influence over the country on either hand. Beyond the Hwang-ho the loess country was entered, and the expedition experienced great difficulties in attempting to travel by any but the one trunk road through it, the peculiar vertical cleavage of the loess placing insuperable difficulties in the way of free communication. By making a short *détour*, in the environs of Honan-fu, the undesirable meeting with the court and its retinue, then returning from Sian-fu to the capital, was, however, avoided. The Lo valley, which was next ascended, had previously been unvisited by Europeans, while the crossing of the Chin-Ling range from Sian-fu to the Yangtse valley was likewise effected by hitherto unknown tracks, so that the geographical results of the journey will here be of considerable importance, especially as the expedition was accompanied by two trained surveyors from Rurki. The subsequent explorations in eastern Suchwan and Hupe are not touched upon in the paper, which concludes

by insisting on the need of prompt and energetic action by British capitalists, if the Yangtse valley is to be opened up by British enterprise.

Scientific Results of Dr. Sven Hedin's last Expedition.—The hope has more than once been expressed in the *Journal* that the means might be found to publish *in extenso* the very valuable scientific material brought back by Dr. Sven Hedin from his last expedition. This hope, we are pleased to state, is now about to be realized, the necessary funds, amounting to 75,000 kroner, or about £4000, having been voted by the Swedish Riksdag in March last. The decision was arrived at "utan votering" (without voting), and the Riksdag is to be complimented on the enlightened aid which it has thus once more given to the cause of science. The general plan of the work, which it is hoped to publish within three years, has already been sketched in the *Journal*. Dr. Hedin himself will contribute two large volumes on the purely geographical results, while the more special branches of science will be dealt with by specialists, who are already working up the material. The work will be published in English, and will no doubt be largely subscribed for in this country.

Earthquake of Andijan.—It appears, from the exact official figures concerning the last Andijan earthquake, that the total number of persons who perished during the earthquake was: 1021 in the town of Andijan, 3342 in 158 villages of the district of Andijan, 285 persons in 106 villages of the district of Marghelan, and four in the district of Osh. Total, 4652 persons. The numbers of cattle killed were also very great, namely, 1375 in Andijan, 1693 in its district, 518 in the district of Marghelan, and 139 in that of Osh. Total, 6725. The number of houses destroyed reaches 34,882, namely, 123 and 9526 respectively in the Russian and the native portions of Andijan, 17,913 in the villages of the Andijan district, 5622 in the Marghelan, and 795 in the Osh district.

The Trans-Siberian Railway. From the report of the last meeting of the Board of Directors of the Siberian Railway, it appears that the main line is now completed permanently except for the portion circling Lake Baikal, which it is hoped will be finished by the close of 1904. The total cost of the line, including the Baikal section, amounted to nearly 385,000,000 roubles. The number of immigrants who have had grants of land allotted to them is 611,491, and for colonization purposes a sum of 30,000,000 roubles has been assigned. To facilitate the acquisition of agricultural implements and seeds, etc., twenty-nine depôts have been established. Arrangements have been made for an efficient prospecting of the country in the neighbourhood of the railway, with the view to the development of its mineral resources, and these have already led to the discovery of oil in the vicinity of Sudjenka, in central Siberia, and near Cheremkhovskoje, in the province of Irkutsk. A special grant has also been made for the encouragement of gold prospecting, and an investigation of the Yenesei and Obi has revealed the fact that these rivers are navigable for ocean steamers for a distance of nearly 1000 miles.

Trade Routes in Siam.—In the report of H.M.'s Consul at Chiengmai it is stated that full surveys are now being carried on, and are almost completed, in connection with the projected main line of railway from Bangkok to the north. This was originally intended to run through Paknampho to Utaradit and Phré, and thence north-westwards to Lampang. Chiengrai, the trade centre on the Me-kok, through which all the Yunnan trade passes, is the ultimate goal. The present surveys, it is understood, favour a direct route along the west bank of the Me-yom, tapping the plain around the prosperous towns of Sawankalok, Pichai, and Pitsanulok, and going nearly due north to Lakhon-Lampang. This town, which is distant 203 miles from Paknampho, is likely to be the centre of the

northern railway system. The line will be extended, not north-easterly by Muang Ngao and Prayao, as originally intended, but somewhat north-westerly along the Me-tui, an affluent of the Me-wang, and across or through the very slight watershed separating the Me-wang from the Me-lao in the Mekong basin into the fertile and populous valley of that stream, where construction would be free from all engineering difficulties right up to the walls of Chiengrai, a distance of about 180 miles from Lakhon-Lampang.

The Late Drought in Cyprus.—The official correspondence relative to the late drought in Cyprus has been published, and shows that the meteorological conditions last year were more unfavourable than at any previous period since the British occupation. In the beginning of June the high commissioner reported that the entire rainfall for the preceding twelve months in the Mesorea plain only amounted to 6·17 inches. The drought was generalized, but was chiefly felt in the Mesorea, which is the principal cereal-producing district. According to a series of records of the island rainfall appended to the report, it seems that the average amount of rain which falls at Nicosia from October to February inclusive —the rainy season—is 10·5 inches, this being the mean of observations from the year 1881. In the winter under consideration, however, the fall recorded during this period was only 3·78 inches. The year 1888 was likewise a drought year, only 5 inches falling during the corresponding period. Turning to the other districts, the deficiency is hardly less striking. In Larnaka 3·17 inches fell, instead of the average 11·27 inches—considerably less than one-third. In Limassol the amount recorded was 6·68 instead of 14·43 inches, and in Famagusta and Kyrenia the figures were 4·14 and 7·81, as against 13·34 and 17·26 respectively. Papho was the only district which did not show a rainfall lower than any previously recorded, but even here only two-thirds of the average fell. Relief works were established and are being maintained until next harvest, the aggregate number employed at the different centres averaging about 2000 daily. Money assistance is also given by Government to solvent farmers who have sown largely, and are without any grain for food.

AFRICA.

The Position of Fort Jameson.—To the longitudes determined in Central Africa by the aid of the telegraph, we may now add that of Fort Jameson, in North-Eastern Rhodesia, which was fixed in December last by means of signals sent from Kimberley at the instance of Sir David Gill. We have been favoured by the Foreign Office with a copy of the letter sent by Mr. Codrington to the South Africa Company, in which the exact method adopted for the determination of the position is described. Local mean time was obtained on December 4, 11, and 17—of the 4th and 17th by equal altitudes of the sun, and on the 11th by ten altitudes taken in the morning and ten in the afternoon. Signals from Kimberley were received on the 6th, 10th, and 16th, the local mean time being, of course, obtained—in the absence of actual observations on those days—by the chronometer rates determined on the 11th and 17th. The resulting longitude in time was 2h. 10m. 40·42s. on the 6th, 2h. 10m. 40·59s. on the 10th, and 2h. 10m. 42·97s. on the 16th. Owing, however, to the considerable variation of the figure for the last date from those of the two first, the longitude has been assumed to be 2h. 10m. 41s., or 32° 40′ 15″ E., which gives a position about 3½m. west of that shown on the War Office map. The latitude, calculated from the meridian altitudes of two pairs of stars, north and south, is 13° 38′ 12″ S. The observations were taken by Mr. Wallace, chief surveyor, with an 8-inch sextant.

Meteorological Institutes in South Africa.—A meteorological head-station has been recently established in Bloemfontein, and sub-stations are being arranged for in Harrismith, Kroonstad, Heilbron, Bethlehem, and Bethulie, it being intended to send the records from these various stations to Bloemfontein. Observations taken so far show remarkable variations of conditions throughout the Orange River Colony, both with regard to the stations as compared with one another, and also to the conditions obtaining in the different stations.

Uniform Time for South Africa.—The Colonial Office gives notice that a uniform time, based on the 30th meridian, or two hours east of Greenwich, has been adopted by all the South African Governments, with the exception of German South-West Africa. On February 28 last, at 11.30 p.m., the time was advanced to midnight in the Transvaal, and similar steps were taken in the other South African colonies, except in Natal, where no change was necessary.

The Du Bourg Expedition.—After the death of its leader (*ante*, p. 319), this expedition continued its route, with some modification of the original plan, under the leadership of M. Golliez, and made its way to the coast by way of the Congo and Brazzaville, reaching France about the end of March (*Revue Française*, April, 1903). From Amadis, the scene of the death of M. Du Bourg, the survivors made their way down the Welle, of which a survey was made from the confluence of the Kibali and Dugu. Its course was found to be very tortuous, and to have been very inaccurately shown on previous maps, so that the survey will be of considerable value for African cartography.

Explorations in French Congo.—M. Alexis Rousset, who last year undertook an expedition for the survey of a route from the Congo to the Shari by way of the Bahr Sara, the important south-western branch of the latter river, has, we learn from the *Revue Française* for April, died on his return to the coast after successfully completing his mission. The route surveyed leads by the Fafa, a tributary of the Bahr Sara, and is said to shorten the journey to the Chad basin from the south by 200 kilometres (125 miles). The Fafa was found to be broken by two rapids only, and to be otherwise suited for navigation. M. Rousset had previously done other good work in this region. Additions continue to be made also, in points of detail, to our knowledge of the Congo tributaries in this region. Thus we learn from the *Mouvement Géographique* (1903, No. 11) that a further exploration of the "Likuala aux herbes," between the Sanga and Ubangi, has been made by M. Vasseur, who ascended the river in a steamer to a little north of 1½° N. lat. At this point it was still 30 yards wide and over 10 feet deep, flowing at the time through an inundated forest, though it sinks to an insignificant stream in the dry season. The natives in this part were hostile, but lower down were more friendly, and showed no fear or surprise at the sight of the steamer. In a map which accompanies the note, account has been taken of the work of the recent Franco-German boundary commission (*ante*, p. 457), which shows that the Sanga and Ubangi are closer together than has been supposed. The thirteenth number of the same journal gives a short account of a recent exploration, by Captain Scheerlinck, of the Pama, an important upper branch of the Alima, first explored in 1883 by Dr. Ballay. It flows for a long distance from south-west to north-east, parallel to the upper Alima.

Exploration of Southern Angola.—It is stated in the *Deutsche Kolonial-zeitung* (No. 14, 1903) that the results of an expedition sent out in 1900 by Kolonial-wirtschaftliche Komitee, in association with the Campanhia de Mossamedes and the South-West Africa Company of London, are about to be published in a full report by experts on the subjects to which attention was mainly directed, viz. the economic resources of this part of West Africa. The district explored

was the *Hinterland* of Mossamedes, especially the region between the Kunene and Zambezi, and it is stated that the new light thrown on the botany of this country is of special importance, no expedition since the days of Welwitsch and Schweinfurth having brought back botanical collections of such value, while the studies of economic plants, especially rubber, are also of great interest. The expedition referred to seems to be that of which mention was made in the *Journal* for December, 1899 (p. 665), though authority was there given for the statement that it started in August of that year, and not in 1900. The leader of this expedition was the botanist, Dr. Baum.

The Spanish Colonies in West Africa.—In the *Bol. de la R. Soc. Geogr. de Madrid* Sr. E. d'Almonte gives the following areas and populations:—

	Area in sq. m.	Pop.
Continental territory	9890	137,000
Fernando Póo	800	19,542
Annobon	6¾	1,303
Corisco	5½	732
Elobey Isles	1	318
Totals	10,703¼	158,890

The areas are only approximate, and the population of the continental territory can only be a very rough estimate, and is probably too large. The population of Fernando Póo is taken from the census of 1901. The white inhabitants are very few, namely, 501 in Fernando Póo, 6 in Annobon, and 12 in Corisco. The continental territory, definitely secured to the Spanish crown by the Franco-Spanish treaty of 1900, extends along the coast from 1° to 2° 10′ N. lat., between the rivers Muni and Campo. The coast consists of plains or undulating country, beyond which, about 12 miles from the sea, are heights culminating in the Pico Agudo de las Siete Montañas at a height of 2790 feet. La Mitra, between the rivers Congüe and Utongo, rises to 3940 feet, and the culminating height of the territory lies between the Laña and San Benito, attaining some 5900 feet. The rivers are much encumbered with falls and rapids, but the Campo is navigable for some 12 miles from its mouth up to the cascades of Bina by steam-launches, though its bar is difficult to cross, and the San Benito (or Volo) to the cascades of Yobé. The Muni is an estuary into which several rivers flow, and has a maximum depth of 108 feet near the French shore, but vessels entering it must have a draught of less than 20 feet in order to cross Corisco bay. Archæan and Palæozoic rocks seem to predominate in the interior of the country, and secondary formations extend along the coast covered with quaternary deposits. The whole country, except some parts of the coastal belt, is clothed with dense forest, where all the trees and plants of tropical Africa flourish—timber trees, dyewoods, fibres, indiarubber, gums, oil, and coco-palms, etc., and various fruits. Manioc, sweet potatoes, yams, maize, etc., are cultivated to a small extent by the natives, and vanilla, cocoa, and other plants near the settlements. The country is little developed, and the exports consist chiefly of palm oil, indiarubber, mahogany and other timber. The hot and moist climate renders the country unsuitable for European colonization, and the chief settlement, the so-called town of Bata, is only a row of houses along the coast, in spite of the efforts made by the French to foster its growth. There are a few factories in Bata of various nationalities, and others are established on the Rio Muni.

Stationary Dunes in the Sahara.—In the *Comptes Rendus* of the Paris Academy of Sciences (meeting of February 6, 1903), M. Hochreutiner has a note on a special type of dunes on the margin of the Sahara, which differs from the

normal in showing no tendency to move in the direction of the prevailing wind. A good example is that of Ain Sefra, which owes its origin to a local wind-current blowing down the side valley of the Feijet-el-Betum across the longitudinal valley of the Wed-el-Brij, and depositing the sand which it raises on a well-defined area, adjoining, though not touching, the southern wall of the latter. Although quite stationary, the dune presents all the external characters of moving dunes. The writer considers that attempts to fix this dune are unnecessary, though the plantations which have been established are important, from the fact that every inch of soil gained is of value from an agricultural point of view.

AMERICA.

North-Western California.—An examination of the north-western region of California, with a view to testing its capabilities for stock-rearing, has lately been made by Mr. J. B. Davy, of the agricultural experiment station of the University of California, and his report, issued last year at Washington, contains much interesting information on the surface features of the country. North-western California, as a well-marked topographical area, is defined as lying between 39° and 42° N. lat., and between the coast and the inner coast range mountains. Of the seven agricultural and climatal areas into which it may be subdivided, Mr. Davy's examination extended to four, viz. the Interior Plateau belt, the Coast Bluff belt, the Redwood belt (lying between the two first), and the district at the headwaters of the Russian river, which forms a connecting link with the topographical region of Western Central California. The general character of the region is that of a dissected plateau, the Coast Bluff belt having a width of only from 1 to 3 miles, while the Redwood belt seems distinguished rather by its climatal than its topographical features, though the causes which delimit the growth of the forest are not clearly understood. In the plateau belt there are numerous mountain valleys which, by their cool climate, fertile soil, and abundant supply of water and timber, are eminently adapted for dairying, though little is at present done owing to difficulty of transport. The original vegetation has been much modified by farming operations, and even in the wild pastures many valuable native species have been much reduced by heavy grazing, while weedy species have become naturalized. Systematic efforts are needed to improve and renew the pastures, which throughout this belt of country have much deteriorated. The upland ridges of the plateau furnish a still larger area of pasture, being not fitted for general agriculture. They form the summer or annual pastures, while winter feed is found among the woodlands which clothe the gulches and steep sides of the cañons, the principal trees being Douglas spruce and three kinds of oak, one of which is highly valued for its bark. These timbered lands cannot, however, make first-class pastures, though something may be done to improve the open spaces. But, as the writer insists at various parts of the report, the timber and brush are most important for the preservation of the water-supply. Other types are the "Chaparral" areas—consisting of dry, stony ground covered with a dense brush of prickly or rigid shrubs—and the sub-alpine meadows, which, being completely isolated, retain the character of the primitive flora. They are valuable as supplying green pasturage for several weeks after the lower upland pastures are dry and brown. The soils on the coast bluffs or "mesa" lands differ materially from those of the plateau and valleys, but, though little suited for sheep, supply some excellent cattle ranges. The coast is fringed with sand-dunes, and Mr. Davy enters fully into the question of their planting with sand-binding species. Some of these have a certain forage value, but the wisdom of stock-feeding on reclaimed dunes is doubtful. Grasses are scarce in the Redwood belt, which, as a rule, is densely shaded, and clearing is, of course, opposed to the interests of the lumber trade.

AUSTRALASIA AND PACIFIC ISLANDS.

Recent Work in New Guinea.—The Annual Report for 1900–1901 on British New Guinea, issued last year at Brisbane, contains, as usual, a large amount of interesting matter relating to the country and its inhabitants, though the multitude of subjects treated of makes it a matter of some difficulty to sift out the geographical items from the mass of other matter. The Reports of the Lieut.-Governor on his visits of inspection are of interest principally as showing the general progress towards the development and pacification of the territory, the statements as to the progress of planting in various parts being on the whole encouraging. Among other visits paid during the year, those to some of the island groups in the extreme east, and that to the Aird River delta for the investigation of the murder of Mr. Chalmers and his companions, may be specially mentioned. In describing a visit to the north-eastern division, the Lieut.-Governor gives a striking description of the Goropu range, the highest point of which, some 10,000 feet high, has recently been named "Mount MacGregor." A new Government station for this division has been founded on Tufi inlet, just north of Cape Nelson, and a photograph taken from this station looking up the winding inlet to the imposing peaks, Mounts Trafalgar and Britannia, is reproduced. Various reports by subordinate officials describe journeys into the interior, some of which have resulted in considerable additions to our knowledge. The expedition from the coast near Cloudy bay across the main range to the headwaters of the Musa has already been referred to in the *Journal*, but attention may be called to the photograph of the gap in the Mount Suckling range through which one of the upper branches of the Musa cuts its way to the north. Further light on the upper system of the Musa was thrown by an expedition which started from the shores of Collingwood bay, on the north-east coast, with the object of discovering and punishing the interior tribes whose murderous raids have long been the terror of the dwellers on the shores of the bay. They have been generally known on the coast as "Doriri," and the expedition proved that, as had been conjectured, this name is a general designation for the unruly tribes dwelling on the headwaters of the Musa. The route led round the northern base of the Goropu range, through a district in which many of the streams flowed with a thick milky-looking water, while in traversing their wide flood channels the traveller sometimes sinks to the knees in a kind of pipeclay slush. These strange waterways are attributed to landslips in the Goropu range, which hold back the water, until it at last bursts forth carrying devastation in its train. The banks of one of these streams, the Wakioki, were thickly clothed with Casuarinas, while on the spurs of the range grew huge mountain pines towering high above the other tall forest trees. After crossing the divide to the Musa system, good views were obtained of the graceful Mount Macgregor and the more massive Mount Suckling a little further south. The Musa and its tributaries were found to be deep and impetuous streams, the crossing of which involved considerable difficulties. The headwaters of another of the north coast rivers—the Kumasi—were investigated by Mr. A. L. Walker, who, in spite of severe fever, made his way for some distance into a broken mountainous district in the vicinity of Mount Lamington, in the Hydrographer's range. This, as well as a portion of the main range, was found to be drained by the branches of the Kumasi, where the supposititious course of the Yodda has hitherto been marked on the map. The Kumasi is a turbulent stream, and Mr. Walker was nearly drowned when attempting to descend on a raft, his native followers restoring him by a process of artificial respiration. In its lower course the river flows through a fertile, thickly peopled country. The report contains many details on the natives and their customs, and there are numerous photos showing their houses (some raised on bamboos

to a height of 30 feet from the ground), carvings, boats, etc. A strange custom which was found to exist among the Fly river natives, and which has been the cause of much trouble, is to the effect that if a "big" man of one village has during his lifetime been a great friend of another village, he makes a secret agreement with the latter to kill all the people of his own village when he dies.

Rainfall of the British Solomon Islands.—Mr. C. M. Woodford gives some information concerning the rainfall of these islands in his lately issued report to the Colonial Office. Records have now been kept at the Government station, Tulagi, for nearly five years, so that some material exists towards obtaining an average. It is customary to speak of the months from April to November as the "dry season," and those from November to March (inclusive) as the "wet season." This coincides with the period of the change of the south-east to the north-west monsoon, and appears to be tolerably well borne out by the records obtained. Roughly speaking, it seems that February and March are the wettest, and May, June, and July the driest months. The annual average for the four years ending with 1901 was just under 130 inches, and this seems to be about what is obtained at Santa Anna and at Ugi, judging from the scanty data available for these latter places.

PHYSICAL GEOGRAPHY.

Temperature in Underground Passages.—Herr Fred. de Bruijn has taken numerous observations of the temperature in the St. Pietersberg quarries near Maestricht (*Tijdschrift van het K. Nederl. Aardrijksk. Genoot.*, Deel xx. No. 1). The average annual temperature is about 48° Fahr., but along the eastern side of the hill, near the chief entrances, it is somewhat less, lying, both in winter and summer, between 44°·5 and 46°·5. The temperature therefore differs considerably from that of Maestricht, where the annual mean is 52°. The cause of this difference is probably evaporation. In winter, when the outer air is colder than that in the quarries, moisture may be given out, and the air in the subterranean passages, absorbing fresh moisture from the damp stone, may be cooled. Evaporation is also caused by convection currents. These are especially marked in the Boschberg and Valberg quarries, on the other side of the Jeker river. The former has eight openings on a level with the passages, and the temperature in these varies with the seasons, while the Valberg has only one opening at a higher level and a more constant temperature. A narrow opening connects the two, through which currents of air flow, the warmer air of the Valberg pouring out in winter into the Boschberg. When the weather is cold, volumes of vapour rise from the Valberg entrance.

The Currents of the Bay of Biscay.—In the January number of *La Géographie*, M. Charles Bénard, president of the Société de Océanographie du Golfe de Gascogne, gives an account of some further experiments with "drifters" carried out by the society. The special feature of the investigation was that the drifters were thrown into the sea in a region intermediate between the open sea area investigated by the Prince of Monaco and the inshore region investigated by M. Hautreux. The results confirm the conclusion that the "Rennell current," properly so called, does not exist, and show that a branch of the general Atlantic circulation enters the Bay of Biscay from the north, flows south-eastwards to the Landes coast, recurves westward along the north coast of Spain, where it moves at the rate of about 3 to 6 miles a day, and then turns southward along the Portuguese coast, rejoining the main current towards the Azores. The society is about to undertake further researches in the north of the bay, and its results in that region may be of special value in relation to the work of the International Survey in the English channel

The Effects of Snow-covering.—The *Bulletin* of the Geological Institution of the University of Upsala (No. 10, 1901) contains an account of an important investigation on the physical conditions of a snow-covering, and its influence on the soil on which it rests, carried out at the Upsala Observatory by MM. Jansson and Westman between January and April, 1902. The observations were made daily at two independent stations, and include (1) records of depth of snow, (2) temperature of snow and soil, (3) specific gravity of the snow, (4) influence of evaporation and condensation on the thickness of the snow-covering, (5) the melting of the snow. Increased depth of snow is due either to snowfall or to drifting; the depth is diminished by internal changes in the density of the snow, which occur even when there is no melting, by the access of warmth due to rain, warm winds, or solar radiation, and by drifting. The heat effect of warm rain is of little importance compared to that of a warm wind. A comparison of the thickness of the snow-covering with the amount of precipitation gives as a mean result, that 1 centimetre of snow is equivalent to 1 millimetre of rainfall. The temperature observations show that, while in a thin layer at the surface the minima are considerably lower than those of the air, on account of radiation, the snow is in general warmer than the air, so that, while a thin coating of snow reduces the temperature of the soil at the surface, a covering 30 to 40 centimetres thick affords great protection. During the whole winter temperature never fell to the freezing-point 10 centimetres below the surface of snow-covered soil, while on ground kept clear of snow it was below freezing from January 31 to April 1 at a depth of 50 centimetres. The specific gravity of the lower layers of snow showed a fairly steady increase from 0·295 on January 11 to 0·372 on April 5, comparison with observations in 1901 showing that the increase depends, to some extent, on the total thickness. The specific gravity of newly fallen snow ranges from 0·038 at low temperatures to 0·161 under humid conditions. On a hard crust formed by melting, the specific gravity rose to 0·489. In the observations of evaporation and condensation wonderfully concordant results were obtained, confirming previous conclusions that in general the effect on the thickness of a snow-sheet from this cause is very slight.

The French Glacier Commission.—The *Commission Française des Glaciers*, instituted in July, 1901, has issued two papers reprinted from the *Annuaire* of the French Alpine Club for 1901. Prof. M. W. Kilian reports on the variations of the glaciers of Dauphiné and the Haute Ubaye observed in 1900 and 1901 by the organization carried on by the *Société des Touristes du Dauphiné*. The report is illustrated by a map and some excellent photographs. The observations show a general diminution of all the glaciers: Prof. Kilian expresses the opinion that the glaciers of the Marinet *massif* have reached a phase of specially rapid decrease, and that they are destined to disappear entirely. All the glaciers of the region are, in effect, entering upon the final stage of a retreat which, notwithstanding minor variations, has been going on continuously since the beginning of the quaternary period. The second paper, by M. Charles Rabot, is a short review of recent additions to our knowledge of glacial phenomena. The first chapter discusses the general aspects of the physical and geological problems under investigation, and in treating the subject of moraines and morainic deposits, M. Rabot deplores the confusion in terminology which still exists, and urges the adoption of the nomenclature recommended by the Glacier Conference in 1899. In the second chapter the most important explorations of glacier regions made during recent years are recorded, and the special features of each region described. The third chapter deals with variations of glaciers, a subject to which M. Rabot returns at greater length in an "Essai de Chronologie des Variations Glaciaires," published in the *Bulletin de géographie historique et descriptive* (No. 2, 1902).

GENERAL.

The Government of Tropical Colonies.—Mr. Alleyne Ireland, author of a well-known work on 'Tropical Colonization,' is at present travelling in the Far East on behalf of the University of Chicago, for the purpose of studying on the spot the problems of colonial administration in the various tropical colonies in that region, and the manner in which they have been solved. Some of the main results of his studies are being communicated to the New York *Outlook* in a series of articles, the first of which appeared in the issue of that paper for November 22 last. This first article sums up in a telling way the main principles underlying, in the author's opinion, the question of colonial administration in the tropics, and its main points may be here summarized. Mr. Ireland begins by insisting on the fact that civilization is the product of geographical environment, and that of the unchangeable factors of such environment which are of primary importance in the problem, climate is the one which has the most marked effect in differentiating existing civilisations. Defining as the "heat belt" of the globe the area enclosed within the northern and southern isotherms of 68° Fahr., he finds that, apart from the work of Europeans and Americans in the tropics, the civilization of the heat-belt has remained stationary a thousand years, and that the advancement of humanity during that period has been carried out entirely by the dwellers outside the limits fixed. This overwhelming disparity, which must be taken into account by all students of colonial problems, is not, in his opinion, a condition which may be subject to reversal, but is the result of definite laws. The beginnings of civilization must be sought either in countries where, from the nature of the climate, the labour conditions have been favourable to the production of a steadfast thrifty people,* or where, from the nature of the soil, the return to labour was great and favoured the easy accumulation of wealth. The latter cause is the more rapid in its action, and we therefore find that civilization appeared first in the early tropical states—India, Egypt, Peru, etc.; but depending on the fertility of the soil, and not on the energy of man, it carries the seed of its own destruction, and is supplanted by the more permanent civilization evolved from successful conflict with nature. In applying these principles to existing problems of colonial administration, Mr. Ireland holds that the character of such administration must be controlled by the ideals of the dominant power, and that in tropical colonies, whatever ideals—native or Western—are to prevail, the substantial control must remain in the hands of the representatives of such ideals. In his second paper Mr. Ireland studies the problem as it is presented in Hong Kong, and shows that, in spite of exceptional difficulties, England has achieved a work which can only call for admiration.

A Sixteenth-century Cartographer.—From the publishing house of Carlo Clausen in Turin there comes a pamphlet entitled 'Notizie sulla vita e sulle opere di Giacomo Gastaldi,' with a preface by Prof. Luigi Hugues. About the life of Gastaldi there exists considerable speculation. He was born at Villa Franca, in Piedmont, but lived mostly at Venice. So much is known with certainty, for his fame secured for him mention by chroniclers both contemporary and subsequent; but the details are hard to fill in. His relations with the Church are interesting in their uncertainty. It has been supposed that he was a friar or canon regular of the Premonstratensians (an order founded by St. Norbert), but in

* Mr. Ireland regards extreme heat as an equally effective bar to civilization as extreme cold, the extreme dryness of the soil in summer rendering continuous labour throughout the year impossible. This is, however, far from applying universally in the tropics.

this case he would not have been permitted to reside as he did in Venice, or indeed in Italy, without a special dispensation; and there is no record that he received this mark of favour. It does not, however, appear impossible that this recognition of Gastaldi's altogether exceptional talents would be denied him, for the highest interests in Venice at that time tended towards geographical work. Venice, lying as it did at the junction between the sea-way of the Adriatic and the land-ways north through Brenner, and east across the low Alps to the Semmering, was forced, by its commanding position for trade, into the necessity for a detailed knowledge at least of the Mediterranean coasts, for in this sea lay all its interests and its colonies. And Venice, at the period of Gastaldi's career, was experiencing a great geographical renaissance—a last outburst of activity in the close study of its own world and the world beyond, before the decline of its political power. Gastaldi had many masters under whom to study, and the best proofs of his extraordinary ability are furnished in the eleventh chapter of the present pamphlet. Here are to be found comparative tables of Gastaldi's computations of the positions of several well-known points both within and without the Mediterranean area, with which are contrasted modern results and those of Mercator and the geographers subsequent to Gastaldi. A geographer of four centuries back who errs only 5′ in computing the latitude of a point relatively so far distant from his own known area as Cape Verde (Mercator's error was 1° 13′) is entitled to high esteem. His workings of longitude are, as would be expected, further away from modern results than those of latitude, but his error of 9° for Bab-el-Mandeb is altogether exceptional; and it is in comparison with the work of other early geographers that Gastaldi shines most notably.

Medals of the Imperial Russian Geographical Society.—At its annual meeting, the Russian Geographical Society awarded its Constantine Gold Medal to P. K. Kozloff for his last researches and geodetical measurements in Tibet, his excellent maps, and most valuable zoological and botanical collections. The Count Lütke medal was awarded to N. M. Knipovich, for his researches in the Arctic ocean, and to N. A. Sokoloff, for his geological and geographical work. The large gold medals of the section of Ethnography were awarded to Prof. V. A. Zhukovsky, for his work on folk-lore in Persia, and to V. N. Perets, for ethnographical work. The Semenoff Medal was given to L. I. Brodovsky, for the map of Manchuria which he has compiled. Small gold medals were given to A. K. Kuznetsoff, for the work he has done in the museum of the Chita (Transbaikalian) section of the Geographical Society; to V. H. Ladyghin, for his work during the Kozloff Tibet Expedition; and to L. S. Berg, for his exploration of Lake Aral. A number of silver medals for various minor works were given to several persons. The greatest achievement of the Geographical Society was the visit to Lhasa by a member of the Society, the Buryat Lama, M. Tsybikoff, who has also been at a number of monasteries in Tibet, and has brought back 319 volumes of various works of Buddhist philosophy, medicine, history, and so on.

New Geographical Society.—The first meeting of the newly founded Russian Society of Earth-Knowledge (*Obshestvo Zemlevyedeniya*) took place on March 5 at St. Petersburg (cf. *Journal*, vol. xix. p. 763). The Society is connected with St. Petersburg University, and has the following programme: (*a*) The study of scientific questions of Earth-knowledge; (*b*) geographical exploration in general, and especially local; (*c*) the improvement of methods of geographical education; and (*d*) the spreading of geographical knowledge. Prof. Brunov was elected as president of the Society, D. A. Koropchevsky as vice-president, and MM. Zverintseff and Schönberg as secretaries.

OBITUARY.

Dr. Gustav Radde.

We regret to announce the death of Dr. Gustav Radde, Gold Medallist and Honorary Corresponding Member of the Society. Gustav Radde was born on November 27, 1831, in Danzig, the son of a schoolmaster. As a youth he was befriended by Dr. A. Menge, and assisted by the Natural History Society of his native town to start on a scientific career. Still quite a young man—that is, in 1852–1855—he had the good fortune to be employed in the Crimea by the old botanist Steven in collecting plants and as a draughtsman for making drawings of plants. Under the guidance of his enthusiastic master, Radde travelled on foot over most of the hilly parts of the Crimea. During that time he also made the acquaintance of a local landowner, M. Shatiloff, for whom he made a Natural History Museum, which, at a later date, was presented to the Moscow University. During these years he published several valuable articles in the *Bulletin de la Société des Naturalistes de Moscou* ("Versuch einer Pflanzenphysiognomik Tauriens," 1854; "Beiträge zur Ornithologie Russlands," 1854; "Thierleben am Faulen Meere," 1855), and one on the Crimean Tartars in the Journal of the Russian Geographical Society (1857). Botany, zoology, and ethnography were thus already his favourite subjects.

In 1855 began the great period of exploration of Eastern Siberia. Steven recommended Gustav Radde to the Geographical Society for this task, and in that year Radde went as a botanist and a zoologist to that country and to the newly annexed Amur region with the expedition under Ludwig Schwartz. He travelled there for four years, made the tour of the northern part of Lake Baikal, then almost unknown, observed the migrations of birds in Transbaikalia, and spent a full year in the Little Khingan, studying the fauna and the vegetation of the southern portion of the Amur. In 1858, after the expedition had terminated its work, he made an extremely interesting journey to the highlands of the Sayan (Irkut valley) and to the peak Munku-Sardyk, the only snow-clad peak on the frontier of Eastern Siberia. The collections which he brought in from Siberia were immense, and included specimens of 1760 vertebrates and about 50,000 invertebrates.

The results of these journeys are embodied in two quarto volumes of his 'Reisen im Süden Ost-Sibiriens' (I. 'Die Säugethierfauna,' 1862; II. 'Die Festlands-Ornis,' 1864), published by the Russian Geographical Society and containing the description of his extremely valuable zoological collections, and in a volume of shorter reports, entitled 'Berichte über Reisen in Süden Ost-Sibiriens,' published in vol. xxiii. of Baer und Helmersen's 'Beiträge zur Kenntniss des Russischen Reichs,' 1861. These reports are admirably written, especially in the part which deals with Radde's journeys up the valley of the Irkut and to the Munku-Sardyk and the Chohondo region. His intelligent study of the method of Humboldt is perceptible in these reports, and they are the best specimens in all the modern geographical literature of Siberia of a graphic description of the whole of nature, physical and organic, including man, as it appears in these highlands. Strangely enough, these 'Reiseberichte,' which might have been such good guides for Russian travellers, have not been published in Russian, but there are Russian editions of the 'Reise.'

In 1864 Radde moved to the Caucasus, where he soon grew interested in the fauna, the vegetation, and the inhabitants of that fascinating and varied region, and founded at Tiflis a Natural History Museum, to which for the rest of his life he devoted his main activity, and which he made one of the richest and best of local museums. He was also the director of the Tiflis Public Library.

His main literary works on Caucasia were 'The Ornithological Fauna of Caucasia' (in Russian) and 'Ornis Caucasica,' which he began to issue in 1885 at Cassel, and of which he published several fascicules, and his 'Berichte über die biologisch-geographischen Untersuchungen in den Kaukasusländern' (Tiflis, 1866). *He published, both in German and in Russian, a great number of separate sketches of his journeys, which appeared, in German, in Petermanns Ergänzungshefte* and *Mitteilungen*—such as "Vier Vorträge über den Kaukasus" (*Ergzh.*, No. 36), "Aus den Hochalpen des Daghestan" (*idem.*, 85), "Karabagh" (*idem.*, 100), "Das Ostufer des Pontus" (*idem.*, 112), "Der Nordfuss des Daghestan" (*idem.*, 117), or in separate volumes, "Khevsuria and the Khevsurs" (Cassel, 1878), 'Talysch und seine Bewohner' (*Leipzig, 1885*); *while in Russian he published* a number of smaller monographs in the *Memoirs* (vols. vii., viii.) and the *Izvestia* of the Caucasus Geographical Society (vols. ii., iv., v.), as also in the Caucasian *Kalendar* (Russian). He also made a journey to the Transcaspian region, described in his 'Preliminary Reports of an Expedition to the Transcaspian Region and the Khorassan,' published (in Russian) at Tiflis in 1891.

In all these works Radde gives excellent and lively pictures of the lands he visited —their fauna, their flora, and their inhabitants—though less beautiful, it must be said, than his Tunka and Munku-Sardyk pictures. He wrote also a good general article, "The Caucasus," for 'Picturesque Russia,' and a sketch of his sea voyage round Asia, 'Twenty-three thousand miles on board the Yacht *Tamara*.' Of his scientific work during the Transcaspian expedition, the first volume only has been published (in German), under the title of 'Wissenschaftliche Resultate der Transcaspischen Wissenschaftlichen Expedition: Band I. Zoologie.' His most important botanical work concerning the Caucasus was 'Grundzüge der Pflanzenverbreitung in den Kaukasusländern,' which constitutes the third volume of the well-known 'Vegetation der Erde,' edited by Profs. Engler and Drude. This is a very serious and most valuable work.

At the time of his death he was engaged in the publication of a work 'Die Sammlungen der Kaukasischen Museums,' of which three volumes (out of six) have appeared (Zoology, Botany, Geology).

In 1898 the Russian Geographical Society awarded to Dr. Radde its chief medal—the Constantine medal—the analysis of his work having been written by Prof. Kuznetsoff (see 'Yearly Report of the Russian Geographical Society' for 1898). He had been awarded the Patron's Medal of the Royal Geographical Society in 1889.

Some of the preliminary reports of Radde, written almost on the spot or immediately after this or that journey in the Caucasus and elsewhere, were from time to time criticized by specialists for small mistakes which he had made here and there. They remain, nevertheless—especially the Siberian reports—models of what reports of journeys ought to be for giving a general picture of the nature of the country visited, embodying its vegetation, its fauna, and the manner of life of its human inhabitants. The writer of these lines cannot recommend any better reading for young geographers than Radde's Siberian 'Reiseberichte;' and if some day a collection of the best geographical reports be made for the use of geographical students—which would be a most desirable enterprise—Radde's reports will surely occupy in such a collection an honourable place. P. KROPOTKIN.

A few days ago I received from Dr. Radde a volume, with a card, "Best greetings; suffering much, but hope to finish the Geology." Before it reached me, the announcement of his death had appeared in the newspapers. For old acquaintance sake, I should like to add a few words to the notice contributed by Prince Kropotkin.

I made Dr. Radde's acquaintance at Tiflis in June, 1868. He and Dr. Abich were then the representatives of science in the Caucasian capital. Caucasia had at that time its own Court and its own administration. Dr. Radde's scientific attainments and their European recognition placed him in the end in such a position that he was selected as the companion of Grand Duke Michael Nicholavich in his yacht voyage to India and Japan, and in 1895 and 1897 he was again selected to accompany members of the Imperial family on a visit to the North African coast-lands.

Time has only strengthened the first impression Dr. Radde made on me as a youth, that of a man with an extraordinarily wide interest and power of observation in various branches of Natural Science. Specialization is no doubt a quality, but it may also be a defect in a traveller. The man who has never made a mistake in life or science has lived and worked in a very narrow groove. Dr. Radde was well fitted to be a pioneer of knowledge in new regions. He was admirably qualified for the receipt of one of the gold medals of the Royal Geographical Society, which was bestowed on him in 1889—nine years before he received the chief medal of the Russian Geographical Society. The formal statement of the grounds of our Society's grant has recently been quoted in Germany as the most complete summary of Dr. Radde's claims, and may, I think, be appropriately repeated here:—

"The Patron's Medal to Dr. G. Radde (Director of the Natural History Museum, Tiflis), for a life devoted to the promotion of Scientific Geography, as a traveller, observer, and author, and particularly for his five years' travels in Eastern Siberia (1855 60), his persistent exploration of the Caucasian chain (1864–5 and 1876–85), Mingrelia, Abkhasia, Karatchai, Daghestan, and of the Armenian Highlands, and the Caspian coast (1875–80), and his services as chief of the Transcaspian Expedition in 1886. Also for the important works in which he has recorded the result of his explorations: (1) 'Reisen in Ost-Siberian, mit Karten,' 1862–4; (2) 'Die drei langen Hochthälern Imeritiens;' (3) 'Vier Vorträge über den Kaukasas,' 1874; (4) 'Aus den Hochalpen des Daghestan,' 1886; (5) 'Die Chewsuren und ihr Land,' 1878; (6) 'Reisen um die Persisch-Russischen Gränzen,' 1885; (7) 'Vorläufiger Bericht über die Expedition nach Manchurien und Khorassan,' 1887. And particularly for the talent with which, while paying special attention to various branches of natural history, especially ethnology, ornithology, and botany, he has kept in view their relations to Geography, and has made it his main object to set out in a clear and comprehensive manner the physical characteristics of the countries he has explored, with their causes and effects (see Nos. 1, 3, and 5). And finally, for the zeal, energy, and artistic intelligence he has exhibited in the arrangement on a Geographical basis of the Natural History Museum at Tiflis."

Douglas W. Freshfield.

Dr. Heinrich Hartl.

Dr. Heinrich Hartl, Colonel of the Reserve, and Professor of Geodesy in the University of Vienna, died in Vienna on April 3, at the age of sixty-three years. Dr. Hartl saw a good deal of active service in the early part of his career, and was known for his services in connection with the determinations of position and the making of route surveys in Turkey for the map of Central Europe on the scale of 1 : 300,000, and the cadastral survey of Bosnia and Herzegovina. But the great work of his life was the organization of the trigonometrical survey of Greece. When the Greek ministry approached the Austrian Government with a request for assistance, Hartl was appointed leader of the Geodetic Commission, which began

its labours in September, 1889. The work in Greece was, to a great extent, directed from Vienna, Hartl's actual presence in the country being only required during a few months in each year. He was thus able to carry on important work for his own country at the same time. He retired from the service in 1898, and in the following year was elected professor in the University. He is the author of numerous papers on cartographical subjects, most of which are published in the *Mitteilungen des K. u. K. Militärgeographischen Institutes* of Vienna, and in the Reports of the Survey of Greece.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1902–1903.

Tenth Ordinary Meeting, March 23, 1902.—Sir CLEMENTS MARKHAM, K.C.B., F.R.S., President, in the Chair.

ELECTIONS:—*A. W. H. Anderson; Lieut.-Colonel A. R. Browne, the Border Regiment; Lieut. Edmund Tillotson Rich, R.E.; Frederick H. R. Sawyer, M. Inst. C.E.; Fred. Snowden, C.E.; Harry Houlton Vivian, J.P.*

HONORARY CORRESPONDING MEMBERS.

M. Alfred Grandidier; Prof. Henri Cordier.

MEDALS AND OTHER AWARDS.

The PRESIDENT: I have to announce that the Council has selected as recipient of the Royal Medals Mr. Douglas W. Freshfield, for his work in the Caucasus, and Captain Otto Sverdrup, for his important discoveries in the Arctic Regions. The names have been submitted to the King, and His Majesty has signified his approval. For the minor awards, Major Burdon, who has made a large number of excellent route-maps in Northern Nigeria, will have the Cuthbert Peek Grant; Captain Isachsen, who was with Captain Sverdrup in his recent expedition, and did a great amount of exploring work, and discovered the two large islands north of the Parry group, is to have the Murchison Grant; Mr. Ellsworth Huntingdon, who made a remarkable journey through the great cañon of the Euphrates river during which he made valuable observations in physical geography, takes the Gill Memorial; and Dr. W. G. Smith, for his investigations into the geographical distribution of vegetation in Yorkshire, takes the Back Bequest.

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Commemoration of the Tercentenary of the Reign of Queen Elizabeth.

Addresses by the President, Sir Clements Markham, K.C.B., Edmund Gosse, Esq. (Raleigh), Julian Corbett, Esq. (Drake), Prof. Silvanus P. Thompson, F.R.S. (William Gilbert and Terrestrial Magnetism), and others.

There was also an Elizabethan Exhibition of Portraits, Globes, Maps, Atlases, Instruments, Navigation Books, Relics, etc.

Special Meeting in the Map Room, Thursday, April 2, 1903, 4 *p.m.*—Sir CLEMENTS MARKHAM, K.C.B., F.R.S., President, in the chair.

Subject:—

"Geographical Education, with Special Reference to his Curved Contoured Maps, Globes, and Reliefs." By Prof. Elisée Reclus.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Austria—Geology. *M.K.K.G. Ges. Wien* 45 (1902): 292–298. **Diener.**
Die Stellung der Croatisch-Slavonischen Inselgebirge zu den Alpen und dem Dinarischen Gebirgssystem. Von Prof. Dr. C. Diener.

Austria—Glacial Epoch. *Sitzb. A.W. München* (1902): 459–486. **Günther.**
Glaziale Denudationsgebilde im mittleren Eisackthale. Von S. Günther. *With Illustrations.*

Austria—Watershed. *M.K.K.G. Ges. Wien* 45 (1902): 221–289. **Schönberger.**
Die Umrandung des Marchbeckens. Von F. F. Schönberger.

Denmark. *G. Tidskrift* 16 (1901–1902): 242–250. **Hartz.**
Interglaciale Aflejringer i Danmark og Nordtyskland. Ved N. Hartz.

Europe—Ethnology. *Globus* 83 (1903): 109–110. **Krause.**
Kann Skandinavien das Stammland der Blonden und der Indogermanen sein? Von E. H. L. Krause.

Europe—Geological. *C. Rd.* 136 (1903): 256–258. **Leriche.**
Sur l'existence d'une communication directe entre les Bassins parisien et belge, à l'époque yprésienne. Note de M. Leriche.

Europe—Historical. **Hughes.**
Shakespeare's Europe. Unpublished Chapters of Fynes Moryson's Itinerary. Being a Survey of the Condition of Europe at the end of the Sixteenth Century. With an Introduction and an Account of Fynes Moryson's Career. By Charles Hughes. London: Sherratt & Hughes, 1903. Size 10½ × 7½, pp. l. and 498. *Facsimiles. Price* 15*s.*

Printed from the manuscript in the library of Corpus Christi College, Oxford.

France—Corsica. **Rikli.**
Botanische Reisestudien auf einer Frühlingsfahrt durch Korsika. Von Dr. M. Rikli. Zürich: Fäsi & Beer, 1903. Size 9½ × 6½, pp. xiv. and 140. *Illustrations. Presented by the Publishers.* [To be reviewed.]

France—Quercy. *B.S.G. Com. Bordeaux* 29 (1903): 25–35. **Lestrade.**
Le Quercy. Par P. Lestrade.

The old province of Quercy now forms part of the departments of Lot and Tarn-et-Garonne.

France—Vosges. **Fournier.**
B.S.G. l'Est **21** (1900): 51–65, 205–220, 357–376, 522–542; **22** (1901): 23–44, 167–181, 277–292; **23** (1902): 39–52, 202–218, 293–305.
Les Vallées vosgiennes. Par A. Fournier.

Germany—Weser. *Globus* **83** (1903): 110–113, 124–127. **Behrens.**
Die Weser. Eine hydrographische Darstellung auf Grund des von dem preussischen Wasserausschusse herausgegebenen Weser-Ems-Werkes. Von Dr. Behrens.

Iceland. *G. Tidskrift* **16** (1901–1902): 219–242. **Bruun.**
Sprengisandur og Egnene mellem Hofs- og Vatnajökull. Undersøgelser foretagne i Sommeren 1902 af Kaptajn Daniel Bruun. *With Map and Illustrations.*

Iceland. *G. Tidskrift* **16** (1901–1902): 194–204. **Lund-Larssen.**
Meddelelser om Generalstabens Ekspedition til Island i Sommeren 1900. Ved Kaptajn Lund-Larssen.

Iceland. *M.K.K.G. Ges. Wien* **45** (1902): 240–291. **Pudor.**
Island-Fahrt. Von Dr. H. Pudor.

Iceland—Grimsöe. *G. Tidskrift* **16** (1901–1902): 204–210. **Thoroddsen.**
Et Besøg paa Grimsø. Af Prof. Dr. Th. Thoroddsen. *With Map.*

Italy—Genoa. *Ann. Hydrographie* **31** (1903): 54–58. ———
Plan für Hafenschutzbauten in Genua mit Rücksicht auf die Sturmverhältnisse. *With Plans.*

Italy—Sicily. *B.S.G. Italiana* **3** (1902): 937–941. **Revelli.**
A proposito della recente alluvione nel Modicano. Nota del dott. Paolo Revelli.

Mediterranean. *B.S.G. Italiana* **3** (1902): 941–951. **Marini.**
Densità e temperatura del mare tra Santa Tecla e Capo Molini (Costa orientale della Sicilia). Nota del dott. L. Marini. *With Map and Diagrams.*

Mediterranean. *J.R. United Service I.* **47** (1903): 78–81. **Harkness**
A Question of an Exchange with Spain in the Mediterranean. By Major T. R. Harkness.
Suggests the exchange of Gibraltar for Port Mahon in Minorca.

Mediterranean—Crete. *C. Rd.* **136** (1903): 330–332. **Cayeux.**
Existence du Jurassique supérieur et de l'Infracrétacé dans l'île de Crète. Note de L. Cayeux.

Mediterranean—Crete. *C. Rd.* **136** (1903): 519–521. **Cayeux.**
Les éruptions d'âge secondaire dans l'île de Crète. Note de L. Cayeux.

Mediterranean—Crete. **Wilkinson.**
Trade of Crete for the year 1901. Foreign Office, Annual No. 2932, 1903. Size 10 × 6½, pp. 10. *Price* 1*d.*

Mediterranean—Cyprus. *Quarterly J.R. Meteorolog. S.* **29** (1903): 29–46. **Bellamy.**
Notes on the Climate of Cyprus. By C. V. Bellamy. *With Map.*

Mediterranean—Geology. *C. Rd.* **136** (1903): 474–476. **Cayeux.**
Phénomènes de charriage dans la Méditerranée orientale. Note de L. Cayeux.

Mont Blanc—Glaciers. *B.S.G. Italiana* **3** (1902): 862–878, 918–937. **Porro.**
Ricerche preliminari sopra i Ghiacciai italiani del Monte Bianco (Campagna del 1897). Nota del Prof. F. Porro.

Montenegro. **Wyon and Prance.**
The Land of the Black Mountain. The Adventures of Two Englishmen in Montenegro. By Reginald Wyon and Gerald Prance. London: Methuen & Co., 1903. Size 8 × 5, pp. xviii. and 300. *Map and Illustrations. Price* 6*s. Presented by the Publishers.*

Russia—Cartography. **Stavenhagen.**
Petermanns M. **48** (1902): 224–229, 254–260, 274–278.
Russlands Kartenwesen in Vergangenheit und Gegenwart. Von Hauptmann W. Stavenhagen.

Russia—Magnetism. **Passalsky.**
P. Passalsky. Anomalies Magnétiques dans la région des mines de Krivoï-Rog. Odessa, 1901. Size 12½ × 10½. *Charts. Price* 4*s.*

ORDNANCE SURVEY MAPS.

THE following is a list of the various Ordnance Survey Maps of the British Isles on sale to the public, together with the prices. E. Stanford, 12, 13 and 14, Long Acre, W.C., is the London agent; there are also provincial agents in most of the important towns of England, Scotland, and Ireland. In places where no agent exists, the maps can be obtained through the principal local post offices.

10 miles to 1-inch Scale.

	Price per sheet. *s.*	*d.*
1.*Great Britain, engraved. Printed from a transfer from copper, with water in blue, latitude and longitude not marked. Size about 20 × 13 inches. On paper	1	0
4 miles to 1-inch Scale.		
2. England and Wales, engraved in black, latitude and longitude marked, no hill shading or contours. Size 22½ × 15 inches. On paper	1	6
3.*England and Wales, engraved. Printed from a transfer from copper, hills in brown, roads sienna, water blue, woods green. Size 22½ × 15 inches. On paper	1	6
4. Scotland, engraved. Printed from a transfer from copper, with water in blue, latitude and longitude marked, no hill shading or contours. Size 18 × 12 inches. On paper	1	0
5.*Scotland, engraved. Printed from a transfer from copper, hills in brown, roads sienna, water blue, woods green. Size 18 × 12 inches. On paper	1	0
6.*Ireland, engraved. Printed from a transfer from copper, with water in blue. Size 18 × 12 inches. On paper	1	0
7.*County and District Maps of Great Britain, cheap edition, roads in brown, latitude and longitude marked, on thin paper or folded in covers. In sheets. Unmounted . . . 6*d.* and	1	0
Folded in covers . . . 9*d.* and	1	0
2 miles to 1-inch Scale.		
8.*England and Wales (part of), engraved. Printed from a transfer from copper, hills and contours in brown, first-class roads burnt sienna, woods green, water blue, latitude and longitude marked. Size 18 × 12 inches. Mounted on linen and folded in cover	1	0
1-inch Scale.		
9. England and Wales, outline, contours in black, latitude and longitude marked. Size 18 × 12 inches. On paper	1	0
10.*Ditto, hills hachured in brown, latitude and longitude marked. Size 18 × 12 inches. On paper	1	0
11. Ditto, hills hachured in black, latitude and longitude marked. Size 18 × 12 inches. On paper	1	0
12.*Ditto, hills hachured in brown, contours red, roads sienna, water blue, magnetic variation shown, latitude and longitude not marked. Size 18 × 12 inches. On linen-backed paper, either flat (with a few exceptions) or folded in covers. Single sheets	1	0
Combined sheets	1	6

* Publication in progress.

	Price per sheet. s.	d.
13. Scotland, outline and contours in black, latitude and longitude marked. Size 24 × 18 inches. On paper	1	9
14. Ditto, hills hachured in brown, and black contours, latitude and longitude marked. Size 24 × 18 inches. On paper	1	6
15. Ireland, outline, not contoured, in black, latitude and longitude marked. Size 18 × 12 inches. On paper	1	0
16.*Ditto, outline, not contoured, in black, latitude and longitude marked, showing county, rural, urban, and county borough boundaries in red. Size 18 × 12 inches	1	0
17. Ditto, hills hachured in black, latitude and longitude marked. Size 18 × 12 inches. On paper	1	0
18.*Ditto, hills hachured in brown, roads sienna, water blue, woods green, latitude and longitude marked. Size 18 × 12 inches. On linen, backed paper, either flat or folded in covers	1	0
19.*Combined maps of areas round certain large towns, or other areas, such as the New Forest and Lake District, and published in various forms and sizes. These maps usually show outline and contour in black and roads in brown. In sheets, unmounted . . . 9*d.* to	1	6
Folded in cover . . . 1*s.* to	1	6

6-Inch Scale

	s.	d.
20. Great Britain, water coloured blue or back lined, contours in black, latitude and longitude marked.		
Heliozincographed or photozincographed. Size 18 × 12 inches	1	0
Engraved or photozincographed (where not published in quarter sheets). Size 36 × 24 inches	2	6
21. Ireland, engraved or heliozincographed, contours in black, latitude and longitude not marked. Size 36 × 24 inches	2	6

$\frac{1}{2500}$ Scale.

	s.	d.
22. Houses ruled in black, water blue or back lined, latitude and longitude not marked. Size 38 × 25½ inches	3	0
23. Houses red, water blue, roads brown, latitude and longitude not marked. Unrevised editions only coloured in this form. Size 38 × 25½ inches. From 2*s.* 6*d.* to 23*s.*, according to the amount of colouring. This form is gradually being superseded by 20.		

Town Scales.

	s.	d.
24. $\frac{1}{500}$ scale, houses stippled. Size 38 × 25½	2	6
25. Ditto, houses ruled. Size 38 × 25½	2	6
26. Ditto, houses red, water blue, roads brown. Size 38 × 25½ inches. From 2*s.* 6*d.* to 15*s.*, according to the amount of colouring. Applies to unrevised only.		
27. 5-feet scale, houses stippled. Revised. Size 36 × 24 inches	2	6

Index Maps.

	s.	d.
28. Indexes to the sheets of the 1-inch scale maps of England and Wales, Scotland, and Ireland, scale 30 miles to an inch. Sizes about 18 × 13 inches	0	2
29.*Index to the sheets of the 6-inch scale map, parishes coloured.		
England and Wales. Size 18 × 12 inches	1	0
Scotland. Size 24 × 18 inches	1	6
30.*Index to the sheets of the 1 : 2500 scale map, parishes coloured.		
England and Wales. Size 18 × 12 inches	1	0
Scotland. Size 24 × 18 inches	1	6

Nos. 29 and 30 are identical with Nos. 9 and 13, but with sheet lines added, printed on thin paper, and coloured to show civil parishes.

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* Publication in progress.

Scandinavia. **Lönborg.**
Finnmarkerna i mellersta Skandinavien. Af Sven Lönborg. (Ur *Ymer*, Årg. 1902, H. 1, 3 och 4.) Stockholm, 1903. Size 9½ × 6½, pp. [114]. *Maps and Illustrations. Presented by the Author.*

Scandinavia. *Ymer* 22 (1902): 505–514. **Wilser.**
Hafva folkinvandringar ägt rum i Skandinavien? Af Dr. L. Wilser.
Discusses the question of former immigrations into Scandinavia.

Turkey—Thasos. *B.S.R. Belge G.* 26 (1902): 475–501. **Hautteœur.**
L'Ile de Thasos. Par H. Hautteœur. *With Map.*

United Kingdom—England. **Thompson.**
The Canal System of England: Its Growth and Present Condition, with particular reference to the cheap carriage of goods. By H. Gordon Thompson. London: T. Fisher Unwin, [not dated]. Size 7 × 5½, pp. 70 and iv. *Price* 1*s*. 6*d*. *Presented by the Publishers.*

United Kingdom—London. **Lethaby.**
London before the Conquest. By W. R. Lethaby. London: Macmillan & Co., Ltd., 1902. Size 8½ × 5½, pp. xii. and 218. *Illustrations. Price* 7*s*. 6*d*. *net. Presented by the Publishers.*

United Kingdom—London. *Fortnightly Rev.* 72 (1902): 796–805. **Miller.**
Port of London. The coming reform. By F. Miller.

ASIA.

Afghanistan. *G.Z.* 8 (1902): 665–686. **Immanuel.**
Afghanistan. Von Hauptmann Immanuel.

Central Asia. *Meddelanden G. Fören. Finland* 6 (1901–1903): pp. 14. **Brotherus.**
Vegetationsskizzer fran Centralasien. Af V. F. Brotherus. *With Illustrations.*

Central Asia. *Scottish G. Mag.* 19 (1903): 113–141. **Hedin.**
Three Years' Exploration in Central Asia, 1899–1902. By Dr. Sven Hedin.

Central Asia. *G. Tidskrift* 16 (1901–1902): 250–259. **Olufsen.**
Sommeren i Centralasien fra Kaspihavet til Ferghanas Østgrænse. Af O. Olufsen. *With Map.*

Central Asia—Pamirs. **Olufsen.**
The Second Danish Pamir Expedition: Meteorological Observations from Pamir, 1898–99. By O. Olufsen. [Copenhagen]: E. Bojesen, 1903. Size 10½ × 7, pp. 92. *Map and Profiles.*

Central Asia—Tian Shan. *Z. Ges. Erdk. Berlin* (1903): 82–121. **Friederichsen.**
Forschungsreise in den Centralen Tiënschan und Dsungarischen Ala-tau im Jahr 1902. Vorläufiger Bericht von Dr. Max Friederichsen. *With Illustrations.*

China. *J. United Service I. India* 32 (1903): 1–23. **Manifold and Hunter.**
Narrative of part of a Journey from Peking to S'such'uan. By Lieut.-Colonel C. C. Manifold and Captain C. G. W. Hunter. *With Map.*

China—Manchuria. *Meddelanden G. Fören. Finland* 6 (1901–1903): pp. 15. **Bohnhof.**
Die Mandschurei und die Ussuri-Provinzen. Reiseskizzen von Hugo Bohnhof.

China—Manchuria. *Asien* 2 (1903): 65–66. **Kleist.**
Die wirtschaftlichen Verhältnisse der Mandschurei. Von v. Kleist.

Eastern Asia. *J.S. Arts* 51 (1903): 313–323. **Carey.**
Tonkin, Yunnan, and Burma. By F. W. Carey.

Eastern Asia. **Krahmer.**
Russland in Asien. Band IV. Russland in Ost-Asien (mit besonderer Berücksichtigung der Mandschurei). Von Krahmer. Leipzig: Zuckschwerdt & Co., 1899. Size 9½ × 6½, pp. vi. and 221. *Maps and Plan.*

French Indo-China. *La G., B.S.G. Paris* 7 (1903): 77–90. **Aïtoff.**
L'Œuvre de M. Pavie en Indo-Chine (1879–1895). Par D. Aïtoff. *With Maps.*

India. **Ferguson.**
Six Weeks' Trip through India: being Notes by the Way. By J. Ferguson. Colombo: A. M. & J. Ferguson, 1902. Size 7½ × 4½, pp. 156. *Map. Presented by the Author.*

India. **Lilly.**
India and its Problems. By William Samuel Lilly. London: Sands & Co., 1902. Size 9 × 5½, pp. xx. and 324. *Map. Price 7s. 6d.*

India—Himalayas. *Alpine J.* 21 (1903): 304–311. **Neve.**
A First Exploration of Nun Kun. By Arthur Neve. *With Map and Illustrations.*
The Nun Kun are lofty twin peaks west of Zanskar.

India—Kumaon. *Mem. Geolog. Surv. India* 32 (1902): 127–184. **Krafft.**
Notes on the "Exotic Blocks" of Malla Johar in the Bhot Mahals of Kumaon. By A. von Krafft, PH.D. *With Map and Plates.*

India—Mica. *Mem. Geolog. Surv. India* 34 (1902): 11–122. **Holland.**
The Mica Deposits of India. By T. H. Holland. *With Maps and Plates.*

Indian Ocean—Andamans and Nicobars. **Kloss.**
In the Andamans and Nicobars. The Narrative of a cruise in the schooner *Terrapin*, with notices of the Islands, their Fauna, Ethnology, etc. By C. Boden Kloss. London: John Murray, 1903. Size 9½ × 6½, pp. xvi. and 374. *Illustrations. Price 21s. net. Presented by the Publishers.* [See review, *ante*, p. 537.]

India—Rajputana. *Mem. Geolog. Surv. India* 35 (1902): 1–116. **La Touche.**
Geology of Western Rajputana. By T. D. La Touche. *With Map and Plates.*

Malay Archipelago—Celebes. **Veenhuijzen.**
Tijds. K. Ned. Aard. Genoots. Amsterdam 20 (1903): 35–66.
Aanteekeningen omtrent Bolaäng-Mongondo, ontleend aan het verslag over eene reis van 7 April tot en met 20 Mei 1900, tot onderzoek naar de gemeenschappelijke grenzen van de Minahassa en het landschap Bolaäng Mongondo. Door A. C. Veenhuijzen. *With Map.*
Noticed in the Monthly Record for March (*ante*, p. 318).

Malay States—Railways. *P.I. Civil Engineers* 150 (1902): 325–339. **Hanson.**
Federated Malay States Railways, Perak and Province Wellesley. By C. R. Hanson. *With Plans and Sections.*

Pamirs. **Filchner.**
Ein Ritt über den Pamir von Wilhelm Filchner. Berlin: E. S. Mittler u. Sohn, 1903. Size 10½ × 7, pp. x. and 238. *Maps and Illustrations. Price 8s. 6d.*

Russia—Siberia. *La G., B.S.G. Paris* 6 (1902): 252–254. **Labbé.**
La prise et la débâcle des rivières de Sibérie en 1901. Par P. Labbé.

Russia—Transcaucasia. *Naturw. Wochenschrift* 2 (1903): 195–199. **Rossmässler.**
Die Halbinsel Apscheron. Von F. Rossmässler.

Russian Central Asia. *M.G. Ges. Hamburg* 18 (1902): 200–267. **Friederichsen.**
Reisebriefe aus Russisch Central-Asien. Von Dr. Max Friederichsen.

Russian Central Asia. **Lipsky.**
Upper Bukhara, Results of three years' travels in Central Asia in 1896, 1897, and 1899. V. I. Lipsky. Part ii. [In Russian.] St. Petersburg, 1902. Size 11½ × 9, pp. 319–541. *Illustrations.*

Turkey—Asia Minor. *Petermanns M.* 48 (1902): 270–274. **Schaffer.**
Zur Geotektonik des südöstlichen Anatolien. Von Dr. F. Schaffer. II. Studien auf einer Reise im Sommer 1901.

Turkey—Euphrates. *B. American G.S.* 34 (1902): 301–310, 384–393. **Huntington.**
The Valley of the Upper Euphrates and its People. By E. Huntington. *With Maps and Illustrations.*
An account of Mr. Huntington's journey appeared in the *Journal* for August, 1902 (vol. xx. p. 175).

Turkey—Jeddah and Hodeida. **Devey.**
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Jade. By S. E. Easter. *With Maps.*

Ethnology. **Frobenius.**

Völkerkunde in Charakterbildern des Lebens, Treibens und Denkens der Wilden und der reiferen Menschheit Von Leo Frobenius. I. Band. Aus den Flegeljahren der Menschheit. II. Band. Die reifere Menschheit. Hannover: G. Jänecke, 1902. Size 8½ × 5½, pp. xii., 416, and 464. *Illustrations. Price 15s.*

Ethnology—Germans and Slaves. **Lefèvre.**

Germains et Slaves: origines et croyances. Par André Lefèvre. Paris: C. Reinwald, 1903. Size 7 × 5, pp. 320. *Maps and Illustrations. Price 3s.*

Deals largely with mythology and allied subjects, but the sections concerned with

the past history and movements of the races are of interest from the point of view of historical geography.

Historical. *Ann. G.* 11 (1902): 448–451. **Gallois.**

La lettre de Toscanelli à Christophe Colomb. Par L. Gallois.

Historical—Columbus. **Alba.**

Nuevos Autógrafos de Cristóbal Colón y Relaciones de Ultramar. Los publica La Duquesa de Berwick y de Alba. Madrid, 1902. Size 11½ × 8, pp. 294. *Presented by La Duquesa de Alba.*

The former collection of documents, published in 1892, has also been presented to the Society, as well as the catalogue of the collections at the Liria palace, printed in 1898.

Historical—Travel. ———

An English Garner. Voyages and Travel mainly during the Sixteenth and Seventeenth Centuries. With an Introduction by C. Raymond Beazley. Two vols. Westminster: A. Constable & Co., 1903. Size 9 × 5½, pp. (vol i.) xxviii. and 332; (vol. ii.) xxiv. and 444. *Price 4s. per volume. Presented by the Publishers.*

BIOGRAPHY.

Boggiani. *B.S.G. Italiana* 3 (1902): 1039–1047. **Giglioli.**

Guido Boggiani. Cenno necrologico del E. H. Giglioli. *With Portrait.*

Boggiani was lately assassinated by the Indians of the Chaco.

Hariot. **Stevens.**

Thomas Hariot, the Mathematician, the Philosopher, and the Scholar; developed chiefly from dormant materials, with notices of his Associates, including biographical and bibliographical disquisitions upon the materials of the history of "Ould Virginia." By Henry Stevens. London: Privately printed, 1900. Size 6½ × 4½, pp. 214. *Price 15s.*

Hooker. **Hooker.**

A Sketch of the Life and Labours of Sir William Jackson Hooker. By Sir J. D. Hooker. (Annals of Botany, vol. xvi. No. lxiv., December, 1902.) Size 10 × 7, pp. ix.–xc. *Portrait. Presented by the Author.*

Keppler. **Müller.**

Johann Keppler, der Gesetzgeber der neueren Astronomie. Ein Lebensbild, von Adolf Müller, S.J. Freiburg im Breisgau: B. Herder, 1903. Size 9½ × 6, pp. viii and 186. *Presented by the Publisher.*

Leonardo da Vinci. **Baratta.**

Biblioteca Vinciana—N. I. Mario Baratta. Leonardo da Vinci ed i Problemi della Terra. Torino. Fratelli Bocca, 1903. Size 9½ × 6½, pp. xiv. and 318. *Price 12s. 6d. net.*

GENERAL.

Altitude and Respiration. *C. Rd.* 136 (1903): 118–120. **Tissot.**

Recherches sur l'influence des variations d'altitude sur les échanges respiratoires. Note de J. Tissot.

Dutch Colonies. **Zimmermann.**

Die Europäischen Kolonien. Fünfter Band. Die Kolonialpolitik der Niederländer. Von Dr. A. Zimmermann. Berlin: E. S. Mittler und Sohn, 1903. Size 9 × 6, pp. xiv. and 304. *Map.*

This is one of the most useful volumes of the series, as the story of Dutch colonial undertakings is perhaps less generally known in its details than those of the other great colonising powers.

French Colonies. **Dubois and Guy.**

Album Géographique par Marcel Dubois et Camille Guy. IV. Les Colonies françaises. Paris: Armand Colin, 1903. Size 11 × 9, pp. xx. and 244. *Illustrations. Price 18 fr.*

This is the fourth volume of the well-known series of geographical pictures by MM. Dubois and Guy, and gives an excellent idea of the conditions of nature and human life in the French colonies.

German Colonies. ——

Kolonial - Handels - Adressbuch 1903 (7. Jahrgang). Herausgegeben von dem Kolonial-Wirtschaftlichen Komitee. (Beilage zum "Deutschen Kolonialblatt," xiv. Jahrgang.) Berlin. Size 10 × 6½, pp. 198. *Maps.*

German Colonies—Bibliography. **Brose.**

Die deutsche Koloniallitteratur im Jahre 1901. Zusammengestellt von Maximilian Brose. (Sonder-Heft der Beiträge zur Kolonialpolitik und Kolonialwirtschaft.) Berlin: W. Süsserott, 1903. Size 10 × 6½, pp. 66.

Missions. **Beach.**

A Geography and Atlas of Protestant Missions, their environment, forces, distribution, methods, problems, results, and prospects at the opening of the twentieth century. By Harlan P. Beach. Vol. i. Geography. Vol. ii. Statistics and Atlas. New York, 1901. Sizes (vol. i.) 9 × 5½ and (vol. ii.) 14½ × 10; pp. (vol. i.) x. and 572, (vol. ii.) 54 and maps. *Presented by the Author.*

The maps are by Bartholomew.

Statistics. **Keltie and Renwick.**

The Statesman's Year-Book. Statistical and Historical Annual of the States of the World for the Year 1903. Edited by J. Scott Keltie, with the assistance of I. P. A. Renwick. London: Macmillan & Co., 1903. Size 7 × 5, pp. xlviii. and 1364. *Price* 10*s.* 6*d. net. Maps and Diagrams.*

The maps show the new boundaries between Chili and Argentina, and between the Sudan and Abyssinia, and Asiatic railway projects. There are also statistical diagrams on commercial and other subjects.

Travel. **Hartert.**

Aus den Wanderjahren eines Naturforschers. Reisen und Forschungen in Afrika, Asien und Amerika, nebst daran anknüpfenden, meist ornithologischen Studien. Von Ernst Hartert. Berlin, etc.: R. Friedländer & Sohn, 1901–1902. Size 11½ × 7½, pp. xiv. and 330. *Maps and Illustrations. Price 25 m. Presented by the Author.*

Year-Book. ——

Year-Book of the Royal Society of London, 1903. London: Harrison & Sons, 1903. Size 8½ × 5½, pp. 282. *Portrait. Presented by the Royal Society.*

NEW MAPS.

By E. A. REEVES, *Map Curator,* **R.G.S.**

EUROPE.

Balkan Peninsula. **Peucker.**

Karte von Makedonien, Altserbien und Albanien. Scale 1 : 864,000 or 13·6 stat. miles to an inch. Mit kartographischen historischen und statistischen Beilagen zum Verständnisse der makedonischen Frage. Bearbeitet von Dr. Karl Peucker. Vienna: Artaria & Co. *Price* 1.50*m. Presented by the Author.*

A useful little map for general reference in connection with the present Macedonian question. The historical notes which are added give a chronological account of the more important events in connection with the region from the earliest times.

Baltic Sea. **Geinitz.**

Das Stromsystem des nachglazialen Südwest-Baltioums während der Landhebung in der Abschmelzperiode. Entworfen von E. Geinitz. Scale 1 : 500,000 or 7·8 stat. miles to an inch. *Petermanns Geographische Mitteilungen,* Jahrgang 1903, Tafel 3. Gotha: Justus Perthes. *Presented by the Publisher.*

England and Wales. **Ordnance Survey.**

Ordnance Survey of England and Wales:—Revised sheets published by the Director-General of the Ordnance Survey, Southampton, from March 1 to 31, 1903.

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England and Wales. **Bartholomew.**

The Survey Atlas of England and Wales. A series of eighty-four plates of maps and plans, with Descriptive Text, illustrating the Topography, Physiography, Geology, Climate, and the Political and Commercial Features of the Country. Designed by and prepared under the direction of J. G. Bartholomew, F.R.S.E., F.R.G.S. Parts 3 and 4. Edinburgh: John Bartholomew & Co. Under the Patronage of the Royal Geographical Society, 1903. *Price* 2*s.* 6*d. each part. Presented by the Publishers.*

The following are the contents of the above parts :—Part iii.. Text—Climate and Agricultural Statistics. Plates: 72, Section lxi., West Sussex; Section lxii., East Sussex; 81, Plans of Liverpool and Manchester; 83, Plans of Sheffield, Nottingham, Birmingham, and Leicester. Part iv., Plates: 30, Section xix., Doncaster and Retford; 31, Section xx., Lincoln and Louth; 68, Section lvii., Bideford and Launceston; 69, Section lviii., Exeter and Honiton. This atlas is being published in twenty-one monthly parts at 2*s.* 6*d.* each, but as Parts iii. and iv. both appear in April, there will be no part published in May.

Germany. **Braun.**

Der Schilling-See, Ostpreussen. Nach eigenen Lotungen gezeichnet auf Grund der Messtischblätter. Scale 1 : 50,000 or ·78 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1903, Tafel 6. Gotha : Justus Perthes. *Presented by the Publisher.*

London. **Stanford.**

A New Map of Metropolitan Railways, Tramways, and Miscellaneous Improvements. Deposited at the Private Bill Office, November 29, 1902, for Session 1903. London : E. Stanford, 1903.

Portugal. **Serviço do Estado Maior.**

Carta dos Arredores de Lisboa. Scale 1 : 20,000 or 0·3 stat. mile to an inch. Sheets : 1–7, 9–20, 22–44, 59–61, 64, 69, 70, 74, 75, 79, 84, 85. Lisbon : Serviço do Estado Maior.

When complete, this map will consist of eighty-five sheets, each measuring about 18 inches by 17. It will include Lisbon and the surrounding country from Setubal on the south to Lourinhã on the north, and from the coast on the west to Villa Nova on the east. The map is printed in colours, and contours at 10-feet intervals are given.

ASIA.

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, 4 miles to an inch. Sheets: 8 N.E., parts of district Dera Ghazi Khan, Bahawalpur (Native State), additions to 1897, 1902. 35 N.W., parts of Native States of Udaipur, Tonk, and Jodhpur (Rajputana), Gwalior, and Indore (C.I. Agency), additions to 1901. 42 N.E., parts of districts Shimoga and Chitaldroog (Mysore), additions to 1901. 51 N.W., parts of Native States of Gwalior (C.I. Agency), Jaipur, Karauli, Tonk, Bundi, and Kotah (Rajputana Agency), additions to 1901, 1902. 52 N.W., parts of Native States of Gwalior and Indore (C.I. Agency), Udaipur, Tonk, Jhalawar, and Kotah (Rajputana Agency), additions to 1901. 52 S.W., parts of Native States of Indore, Gwalior, Khilchipur, Rájgarh, and Narsinghgarh (C.I. Agency), and of Jhalawar, Kotah, and Tonk (Rajputana Agency), additions to 1901, 1902. 53 N.W., parts of Bhopal, Gwalior (Sindhia), Indore (Holkar), and Dewás (Native States, C.I. Agency), additions to 1896, 1902. 53 S.E., parts of Hoshangabad and Betúl (Central Provinces), and the Native States of Bhopal and Holkar (C.I. Agency), additions and corrections to 1899. 53 S.W., parts of Hoshangabad and Nimár (Central Provinces), Indore, Bhopal, Dewás, Dhár, and Gwalior (C.I. Agency), additions to 1899, 1902. 77 S.E., parts of districts Nellore, Cuddapah, North Arcot, and Chingleput (Madras Presidency), additions to 1899. 87 S.W., parts of districts Bahraich, Bara Banki, Fyzabad, Gonda, Hardoi, Lucknow, Rae Bareli, Sitapur, Sultanpur, and Unao (N.W. Provinces and Oudh), additions to 1901. 87 N.W., parts of districts Kheri, Bahraich, Sitapur, Bara Banki, Hardoi, and Gonda (United Provinces), additions to 1899. 128 N.E., parts of districts Chittagong (Bengal) and Akyab (Burma), additions to 1898, 1899.—The Central Provinces, 16 miles to an inch, 2 sheets, additions to 1901.—Map of the Central Provinces and Berar, 32 miles to an inch, additions to 1901, 1902.—Map of the North-Western Provinces and Oudh, in April, 1901, 32 miles to an inch, additions to April, 1901.—Lower Provinces, Revenue Survey, 1 inch to a mile. Sheet No. 7, district Bhaugulpoor, additions to boundaries, 1897, 1900.—District Darjeeling, 4 miles to an inch, 1901.—District Karnal, 1870-78 and 1887–88, 4 miles to an inch, 1902.—District Patna, 4 miles to an inch, additions and corrections up to November, 1899, 1901.—Assam Survey, 1 mile to an inch. Sheet No. 27 (Preliminary Edition). District Kámrup, Seasons 1884–86, 90–91, and 96–97, 1902.—Bengal Survey, 1 mile to an inch. Sheets : 109, districts Muzaffarpur and Champaran, Seasons 1894–96, 1901 ; (Preliminary Edition) 140, district Muzaffarpur, Seasons 1895–96, 1901 ; 224, district Cuttack, Seasons 1888–89 and 1894–95, 1901.—Bombay Survey, 1 mile to an inch. Sheets : (Second Edition) 97, parts of district Ahmedabad, Baroda State, and Kathiawar Agency, Seasons 1866–67, 1868–69, 1902 ; 187, district Thana, Season 1881–82, 1902 ; 188, Island of Bombay and District Thana, Season 1880–81, corrected up to February, 1898, 1901 ; 204, districts Sátára and Ratnagiri and Kolhapur and Southern Maratha Agency, Seasons 1883–86, corrected up to June, 1899, 1902 ; 214, parts of district Panch Mahâls and Rewa Kantha Agency (Bombay), and of Jhábua (Rajputana), Kusalgarh and Banswara States (Central India), Seasons 1884–85–86, 1902 ; 247, district North Kánara, Season 1895–96, 1901 ; 295, districts Sholapur, Poona and Ahmednagar and Nizám's Dominions, Seasons 1876–78, 1902 ; 296, districts Poona and Sholapur and part of Nizam's Dominions, Seasons 1875–76, 1902 ; 314, part of district Khandesh, Seasons 1875–77, additions and

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Persia. **Stahl.**

Routenkarte von der russischen Grenze nach Tabriz und Kaswin. Von A. F. Stahl. Scale 1 : 840,000 or 13·2 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1903, Tafel 5. Gotha: Justus Perthes. *Presented by the Publisher.*

Turkistan. **Habenicht.**

Die Terraindarstellung im "Neuen Stieler." Von H. Habenicht. Turkestan im "Alten Stieler."—Turkestan im "Neuen Stieler" (Terrain mit Schrift und Schatten).—Turkestan im "Neuen Stieler" (Terrain ohne Schatten und ohne Schrift).—Turkestan im "Neuen Stieler" (Terrain mit Schatten, aber ohne Schrift). *Petermanns Geographische Mitteilungen*, Jahrgang 1903, Tafel 4. Gotha: Justus Perthes. *Presented by the Publishers.*

AFRICA.

Madagascar. **Service Géographique des Colonies.**

Service Géographique des Colonies. M. Camile Guy, Chef du Service. Madagascar. Carte dressée sous la direction de M. Emile Gautier d'après les travaux du Service Topographique de Madagascar, les cartes du Service Hydrographique de la Marine, les levés des missionnaires et les travaux des explorateurs A. & G. Grandidier, E. Gautier, Douliot, Catat, R. Baron, etc. Scale 1 : 500,000 or 7·8 stat. miles to an inch. Paris: Augustin Challamel, 1902. *Presented by the Chef du Service Géographique des Colonies.*

The surveys of the Service Topographique de Madagascar and Service Hydrographique de la Marine, combined with those of various missionaries and other travellers, form the basis of this map. It is orographically coloured, and shows elevations from sea-level to over 2000 metres by means of six different tints. The names of tribes are given in red.

Rhodesia. **Stanford.**

A Map of Rhodesia divided into Provinces and Districts under the Administration of the British South Africa Company. Scale 1 : 1,000,000 or 15·7 stat. miles to an inch. 6 Sheets. London: E. Stanford, 1903. *Price* £1 4*s.*

A new edition revised and brought up to date. Owing to the large amount of fresh information that has been furnished lately by officers of the British South Africa Company and others, it has been found necessary to make many extensive alterations and additions, and two of the northern sheets have been practically redrawn.

AMERICA.

Canada. **Surveyor-General's Office, Ottawa.**

Sectional Map of Canada. Scale 1 : 190,080 or 3 stat. miles to an inch. Pasquia Sheet (38), West of Second Meridian; revised to June 5, 1902: Maple Creek Sheet (58), West of Third Meridian; revised to April 23, 1902: Milk River Sheet (65), West of Fourth Meridian; revised to June 2, 1902: Medicine Hat Sheet (66), West of Fourth Meridian; revised to April 26, 1902: Lethbridge Sheet (73), West of Fourth Meridian; revised to June 3, 1902: Blackfoot Sheet (75), West of Fourth Meridian; revised to June 10, 1902. Ottawa: Surveyor-General's Office. *Presented by the Surveyor-General of Canada.*

United States. **Rand, McNally & Co.**

Indexed County and Township Pocket Maps of Nebraska. Scale 1 : 1,140,480 or 18 stat. miles to an inch. Nevada. Scale 1 : 1,710,720 or 27 stat. miles to an inch. New Hampshire. Scale 1 : 633,600 or 10 stat. miles to an inch. Chicago and New York: Rand, McNally & Co. *Price* $0.25 *each. Presented by the Publishers.*

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GENERAL.

World. **Stieler.**

Neue, neunte Lieferungs-Ausgabe von Stieler's Hand-Atlas, 100 Karten in Kupferstich 15 & 16 Lieferung. Gotha: Justus Perthes. *Price* 60 *pf. each part.*

These two parts, which are in one cover, contain, Nos. 32 and 33, two sheets (Nos. 1 and 2) of a four-sheet map of Spain and Portugal, by O. Vogel, on the scale of 1 : 1,500,000. No. 83, a map of Western Canada, by H. Habenicht, on the scale of 1 : 7,500,000; and No. 85, a small-scale (1 : 12,500,000) general map of the United States and Mexico, by H. Habenicht and H. Salzmann. With the exception of No. 85, the United States and Mexico, all are revised editions, but this latter is entirely new. As large-scale detailed maps of the United States are also given in the atlas, this general map only indicates the leading features of the country as a whole, and very properly contains but few names.

World. **Bartholomew.**

The British Empire Map of the World. By G. R. Parkin, C.M.G., LL.D., and J. G. Bartholomew, F.R.G.S. Scale 1 : 2,700,000 or 42·5 stat. miles to an inch. 2 Sheets. Edinburgh: J. Bartholomew & Co. *Presented by the Publishers.*

This is an educational wall-map of the world in two sheets on Mercator's projection, measuring about 8¼ feet × 5⅜ feet. British possessions are coloured red, and all other countries neutral tint. Principal steamship routes, railways and telegraphs are shown, as well as British and foreign coaling stations. Mr. Stanford Fleming's twenty-four-hour zone notation for a recognized standard uniform time is marked along the upper margin of the map. Apparently with a view to correcting the erroneous idea as to relative sizes of countries due to the projection employed, diagrams are given

at the bottom of the map showing the comparative area of British possessions; but from an educational point of view it would have been preferable to have drawn the map in another projection. There are also diagrams showing the growth of the area, population, and trade of the British Empire.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during January and February, 1903. *Presented by the Hydrographic Department, Admiralty.*

No.		Inches.	
2258 m	=	14·0	England, south coast:—Dartmouth harbour. 2*s*. 6*d*.
3292 m	=	6·0	Scotland, west coast:—Loch Alsh and Kyle Rhea. 2*s*. 6*d*.
1624 m	=	8·0	England, east coast:—Scarborough bay. 1*s*. 6*d*.
2330 m	=	0·7	Norway, south coast:—Christiania fiord. 3*s*.
151 m	=	7·2	France, south coast:—Toulon harbour. 2*s*. 6*d*.
3330 m	=	2·0	Iceland, east coast:—Seidis fiord and trading station. 1*s*. 6*d*.
3328 m	=	1·92	Newfoundland, east coast:—Hall bay and Sunday cove. 1*s*. 6*d*.
3320 m	=	$\left\{\begin{matrix}6\cdot0\\8\cdot0\end{matrix}\right\}$	Newfoundland. Thimble tickles and Glover harbour:—Head of Seal bay. 1*s*. 6*d*.
3306 m	=	2·0	Newfoundland. Trinity bay:—Smith and Random sounds, eastern part. 2*s*. 6*d*.
3307 m	=	2·0	Newfoundland. Trinity bay:—Smith and Random sounds, western part. 2*s*. 6*d*.
3273 d	=	0·95	The West Indies. 2*s*. 6*d*.
3322 m	=	0·35	South America, north-east-coast:—Orinoco river. 2*s*. 6*d*.
3279 m	=	5·95	China:—Hongkong waters, east. 2*s*. 6*d*.
1288 m	=	6·0	China, Yang-tse-kiang:—Chin kiang fu and Silver island. 2*s*. 6*d*.
3328 d	=	4·0	New Zealand, east coast:—Kati Kati harbour. 1*s*. 6*d*.
3321 d	=	6·0	New Zealand, east coast:—Gisborne roads. 1*s*. 6*d*.
2747 d	=	3·0	Australia, south coast:—Entrance to Port Phillips, etc. 3*s*.
972 m	=		Philippine islands. New plan:—Port Romblon.
991 m	=		Japan:—Anchorages on the coast of Yezo island. Plan added:—Monbetsu road.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.	Cancelled by	No.
2258 Dartmouth harbour.	New plan. Dartmouth harbour	2258
2455 Kyle Rhea. 1846 Kyle Akin harbour.	Loch Alsh and Kyle Rhea	3292
1624 Scarborough.	New plan. Scarborough bay	1624
151 Toulon harbour.	New plan. Toulon harbour	151
2330 Svenöer to Koster islands including Christiania fiord.	Christiania fiord	2330
1535 Plan of Seidis fiord on this sheet.	New plan. Seidis fiord and trading station	3330
2852 San Luis pass, etc.		
3181 Plan of Silver island on this sheet.	New chart. Chiang fu and Silver island	1288
2747B Entrance to Port Phillip.	New plan. Entrance to Port Phillip	2747

Charts that have received Important Corrections.

No. A to P, Index charts (16 sheets). 2296, Gulf of Bothnia, Sheet I.:—South Quarken to Hornslandet. 3300, Baltic sea:—Windau. 790, Denmark:—Approaches to Copenhagen. 2690, France:—Brest roadstead. 366, Cape Verde islands. 2740, Iceland and the Færoe islands. 546, South America, east coast:—Espirito Santo bay and port Victoria. 2095, Africa, south coast:—Cape of Good Hope and adjacent coasts. 385, Africa, south coast:—Plettenberg bay. 1223, Africa, south coast:—Kowie river entrance. 643, Africa, east coast:—Port Natal. 2908, Africa, east coast:—Port Natal entrance. 597, Africa, east coast:—Delagoa bay to Guardafui. 644, Africa, east coast:—Delagoa bay. 646, Africa, east coast:—English river, bar and harbour. 650, Africa, east coast:—Plans on the

east coast of Africa. 921, Africa, east coast:—Chiluan island. 1421, Africa, east coast:—River Chiude. 2865, Africa, east coast:—Mouths of the river Zambezi. 653, Africa, east coast:—Ports of Conducia, Mozambique, and Mokambo. 684, Africa, east coast:—Mto Mwara and Mikindani harbours. 681, Africa, east coast:—Lindi river. 677, Africa, east coast:—Mchinga bay. 687, Africa, east coast:—Kiswere harbour. 661, Africa, east coast:—Kilwa Kisiwani. 458, Africa, east coast:—Mafia island and channels. 674, Africa, east coast:—Dar es Salaam. 1310, Africa, east coast:—South-west coast of Pemba island. 1812, Africa, east coast:—West coast of Pemba island. 663, Africa, east coast:—Mansa and Tanga bays. 238, Africa, east coast:—Kilifi river and approaches. 667, Africa, east coast:—Port Malindi and approaches. 1747, Africa, east coast:—Lamu harbour. 669, Africa, east coast:—Lamu, Manda, Patta, and Kwyhu bays. 860, Africa, east coast:—Kisimayu bay. 671, Africa, east coast:—Plans on the east coast of Africa. 760, Madagascar, southern portion:—Cape St. Mary to Bevato island and Matatane. 692, Madagascar:—St. Augustine and Tulléar bays. 2464, Madagascar:—Nosi Andrianmitarika to Mananonoka point. 1986, Madagascar:—Anchorages on the coast of Madagascar. 758, Madagascar, northern portion:—Cape St. Andrew to Antongil bay. 878, Madagascar:—Maromanjo point to Makambytra. 708, Madagascar:—Anchorages on the west coast. 701, Madagascar:—Bombetoke bay. 377, Moramba bay to Maromanjo point. 702, Madagascar:—Mahajamba bay. 704, Madagascar:—Nosi Shaba to Moramba bay. 706, Madagascar:—Pasindava and adjacent bays. 707, Madagascar:—Ambavatobi bay. 1002, Madagascar:—Diego Suarez bay to Andranoaombi bay. 817, Madagascar:—Anchorages on the north-west coast. 1054, Madagascar:—Ports and anchorages in the northern portion. 1064, Madagascar:—Plans on the north-east coast. 1116, Madagascar:—Diego Suarez bay. 680, Madagascar:—Anchorages on the east coast of Madagascar. 759B, Madagascar:—Antongil bay to Ambatosoa. 686, Madagascar:—Anchorages on the east coast. 563, Indian ocean islands:—Plans in the Comoro islands. 2066, Indian ocean islands:—Anchorage in Comoro island. 851, Indian ocean islands:—Bassas da India and Europa island. 883, Bay of Bengal:—Rangoon river. 2987, Philippine islands:—San Pedro bay to Libukau islands, etc. 976, Philippine islands:—Manila bay. 2062, Cochin China:—Tongking gulf. 918, Korea, western coast:—Mackau group to Clifford islands. 2985, Japan:—Saiki bay. 1510, Sandwich islands.
(*J. D. Potter, Agent.*)

North Atlantic Ocean and Mediterranean Sea. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for April, 1903. London: Meteorological Office. *Price 6d. Presented by the Meteorological Office, London.*

United States Charts. **United States Hydrographic Office.**

Pilot Charts of the North Atlantic Ocean for March, and of the North Pacific Ocean for April, 1903. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Andaman and Nicobar Islands. **Man.**

One hundred and eleven Photographs of the Andaman and Nicobar Islands, taken by E. H. Man, C.I.E., Esq. *Presented by E. H. Man, Esq.*

This is a most interesting series of platinotypes carefully selected and arranged in an album. From an anthropological point of view the photographs are important.

(1) Lighthouse on Table island; (2) Volcano on Barren island; (3) Principal anchorage at Port Blair; (4) Port Blair harbour from Government House; (5) Andamanese poling canoe and shooting fish with bow and arrow in creek near Port Blair harbour; (6) Bungalow at Mount Harriet, Port Blair; (7) Sher Ali, the assassin of Lord Mayo; (8, 9, and 13) Andamanese long resident at Port Blair; (10) Andamanese equipped for hunting; (11) Andamanese men long resident at Port Blair; (12) Andamanese women long resident at Port Blair; (14) Native of North Andaman, showing the three rows of tattoo marks which distinguish these natives from those of South and Little Andaman; (15) Typical hut in long-established camping-ground in South Andaman; (16) Typical hut adjacent to that in photograph 15; (17) Andamanese in canoe at Interview island; (18) Andamanese dancing to accompaniment on sounding-board; (19) Typical Little Andaman hut with Onges (natives of that island) and Mr. M. V. Portman; (20) Onges with a Little Andaman canoe; (21) Onges; (22) Natives of Arong village, Car Nicobar, with an Andamanese visitor; (23 and 24) Offandi, headman of Mús village, Car Nicobar; (25–27) Car Nicobarese lads; (28) Natives of Car Nicobar; (29) Mission house of S.P.G. catechist (Madrasi) at Mús; (30) "Nyá-kopáh," sacrificial offering of fruit and vegetables, Car Nicobar; (31) Hut

and "nyá-kopáh" at Mús, Car Nicobar; (32) Typical Car Nicobarese; (33) A common type of hut at Car Nicobar, known as the "talika;" (34) Two "mafai" being carried in covered chairs, Car Nicobar; (35) A village graveyard with mortuary-hut, Car Nicobar; (36) Landing-place at Batti Malve island; (37) Landing-place at Sánénya, Chowra island; (38) Natives of Chowra island; (39) Women making pots at Chowra island; (40 and4 1) Youths of Chowra island; (42) Hut on Teressa island, with grave of recently deceased owner; (43 and 44) Natives of Teressa island; (45) Back of bungalow of officer in charge of the Nicobars at Nankauri island during the existence of the settlement 1869–88; (46) R.I.M.S. *Nankauri*, station steamer at Nankauri island, 1884–88; (47) Malacca village, Nankauri harbour; (48) Malacca village at low spring tide; (49 and 50) Malacca village; (51) Malacca village, showing the two ordinary types of huts; (52) Natives of Nankauri harbour in visiting attire; (53) Inúanga village, Nankauri harbour; (54) Native of Nankauri island playing on bamboo lyre; (55) Native of Nankauri island playing on flageolet; (56) Hut in a Nankauri village; (57 and 58) Native of Nankauri island; (59) Hut on site of the Moravian Mission establishment of 1768–87 near Malacca village; (60 and 61) Natives of Malacca village with four Andamanese youths; (62) Kabila village, Nankauri island; (63 and 64) Typical natives of Nankauri harbour; (65) Canoes at Nankauri, as decorated on a memorial feast day; (66 and 67) An octogenarian of Malacca village; (68) Natives of Nankauri in visiting attire; (69) A fowl cage and a fish trap; (70) A "pomák-ónh" and sucking-pig cage; (71) Natives of Nankauri harbour in visiting attire; (72) Mode of catching rain-water from coconut trees; (73) Burial-ground behind a village at Nankauri; (74) Typical native of Nankauri harbour; (75) A young couple at Nankauri; (76) A native of Nankauri, showing mode of wearing the "neng;" (77 and 78) Native of Nankauri harbour; (79) Inaka village on east coast of Camorta island; (80–83) Types of old men and women; (84) Dáng (headman) and others in front of his hut at Condul island; (85) Natives of Condul island; (86) Natives of Láful village, Great Nicobar; (87) Kopenhéat village, Great Nicobar; (88) Two Shom Peṅ natives in the midst of a group of coast natives in visiting attire; (89) Types of coast and Shom Peṅ natives; (90, 91, 95, and 99) Galatea river, Great Nicobar; (92 and 96) Láful river, Great Nicobar; (93) Plantation of *Pandanus mellori* and coconut trees on east coast of Great Nicobar; (94) Alexandra river, Great Nicobar; (97, 98, 100, 101, 103, and 104) Shom Peṅ natives of the interior of Great Nicobar; (102) Shom Peṅ hut on bank of Alexandra river; (105) Shom Peṅ hut and garden on border of Alexandra river; (107) Shom Peṅ bark cooking-utensil; (107 and 108) A Shom Peṅ woman reared by the coast tribe; (109) Head of Láful river in the dry season; (110) Coast and Shom Peṅ natives; (111) Shom Peṅ clearing near Ganges harbour.

Vegetation Types. **Karsten and Schenck.**

Vegetationsbilder, herausgegeben von Dr. G. Karsten und Dr. H. Schenck. Heft 2. Malayischer Archipel. Von Dr. G. Karsten. Jena: Gustav Fischer, 1903. *Price* 4*m*.

This is the second of a series of eight portfolios in course of publication, containing photographic reproductions illustrating the types of vegetation of different parts of the world. The present issue comprises six plates of the vegetation of the Malay archipelago, from photographs taken by Dr. G. Karsten in 1889, accompanied by descriptive letterpress. The price to subscribers taking the complete work is 2.50 marks for each part, but for one part only 4 marks.

Venezuela. **André.**

Eighty-eight Photographs taken during an Expedition to the Caura river, Venezuela, in 1900–1901, by E. André, Esq. *Presented by E. André, Esq.*

An account of the journey during which these photographs were taken was given in the *Geographical Journal* for September last. They are platinotypes of different sizes, and serve well to illustrate the scenery and native life of this imperfectly known part of South America.

(1) Waiomgomo house; (2, 3, 6, 72, 73, 75, and 88) Rapids of Mura; (4) Arrival at La Prision; (7) A Waiomgomo family; (8) Waiomgomo Indian catching bait; (9 and 10) Fishing with spear; (11) Fishing with bow and arrow; (12) Fishing with hook; (13) Smoking fish; (14 and 15) Making baskets; (16 and 17) Striking a bargain; (18–23) Making cassava; (24–27) Making a hammock; (28) Paying a debt; (29) Primitive cane-crusher; (30) Building a dark room; (31) Jacobson; (32) Pounding corn; (33) Our kitchen; (34) Receiving and counting; (35) Examining; (36) On the way to La Prision; (37) Nearing La Prision; (38) Cleaning plants; (39, 74, and 83) Packing plants; (40) Catching butterflies; (41 and 78) Butterflies; (42) *Nymphalis Orion* butterfly; (43) The relief party ready to start; (44) Cattle mill at La Prision; (45) Isidor, everyday dress; (46) Isidor, full dress; (47) Isidor's wife; (48) Isidor's

wife and children; (49 and 50) Waiomgomo woman and child; (51) Waiomgomo boy and girl; (52) Waiomgomo girls; (53) Maité, who died of starvation; (54) Waiomgomo with flute; (55) Waiomgomo woman; (56) Waiomgomo, Vicente; (57) Mr. André; (58 and 59) Mr. André in the "Pirate's" clothes; (60) Mr. André, starved; (61) Mr. André, photograph taken at Mura; (62) Hospital on the Nichare river; (63) The *Orinoco* at Mapire; (64) The *Caura* taking wood; (65) Ciudad Bolivar; (66) Forest scene near La Prision; (67) La Laja de Los Perros; (68 and 69) Waiomgomo Indian making arrows; (70 and 71) Waiomgomo house: (76) Indians crossing the rapids; (77) Micranda; (79) Departure of the relief party; (80) House at La Prision; (81) Snakes; (82) Waiomgomo making hammock; (84) On arrival at La Prision; (85) Mr. André, May 24, 1901; (86 and 87) Waiomgomo woman making a hammock.

Yunnan. **Watts-Jones.**

Two hundred and thirty-eight Photographs of Yunnan taken by Captain W. A. Watts-Jones, R.E. *Presented by Mrs. W. A. Watts-Jones.*

These photographs have been presented to the Society by Mrs. Watts-Jones, with the permission of the Yunnan Company, as a memorial of her husband, Captain W. A. Watts Jones, R.E., by whom they were taken during his surveying expedition for the railway route from Kunlong Ferry to the Yangtse kiang in 1898–99.

(1 and 4) An upper Irawadi steamer with three flats in tow; (2) An upper Irawadi timber raft; (3) Myothet, first stage on the Bhamo-Tali road; (5) The upper Irawadi; (6) Entrance to a village, showing posts to keep away the evil spirits, Kachin hills; (8) Yang-yu-chang, Kachin hills; (9 and 10) A Kachin village; (11) Mong-na plain, giant bamboo; (12) A village in the Nan-tien valley; (13) First view of the Mong-na plain; (14) Chinese Shan village in Mong-na plain; (15) Typical bit on the Mong-na plain; (16) Remains of ancient lake-bed plain, Nan-tien valley; (17) View of fort, the headquarters of Chinese levy, from near Pong-shi, Kachin hills; (18) Momein city and plain at sunset; (19) Momein city and plain, volcanic cone north of the city; (20) A quiet street in Momein; (21) Chain bridge over gorge between Mong-na and Nan-tien plains; (22) The Ting-Kwan (magistrate) of Momein and family; (23) The Ting-Kwan of Momein and Long-ling, Erh-fu; (24) Sons of Ting-Kwan of Momein; (25) The young Tsawba of Mong-na; (26) Middle gate of Momein; (27) Nan-tien valley, a party of Tibetans; (28) A soldier of the escort and interpreter's mule; (29) Waterfall where river leaves Momein plain; (30) A soldier of the Nan-tein Tsawba; (31) Chian suspension bridge over the Shweli river; (32) San-ko-pa on road from Yung-chang-fu to Shunning-fu; (33) Going down to the Salwen river; (34) Chinese village above Mong-kyen; (35) Mong-hsa market; (36) Chinese woman, Ping-chang; (37) Shan girl Mong-hsa; (38) A Chinese liquor-seller, Mi-pa-chiao; (39) A long-distance transport; (40) A short-distance transport; (41) Mule with two Chinese cooking-pans; (42) The escort carriers: the day's bag; (43) Mong-hsa town and plain; (44) Fording the Nam-ting at Mong-ka-ka; (45) A series of valleys parallel to the Nam-ting valley through which the Kunlong Yun-chau road runs; (46) Exit of Mong-hsa stream; (47) Part of the north wall of the Nam-ting valley; (48) Valley through which the Mong-yawing stream flows down to join the Nam-ting; (49 and 50) Upper gorge of the Nam-ting; (51) Looking south up and across the valley of the upper Nam-ting; (52) Lower gorge of the Nam-ting; (53) Alluvial fans below Mong-lai and head of upper gorge of Nam-ting; (54) A ford of the Nam-ting; (55) Salwen background to Me-kong; (56) Nam-ting valley, mile 128; (57) Nam-ting valley, mile 123; (58) Typical bit of road leading from Nam-ting to the Salwen; (59) Me-kong-Salwen watershed; (60) Valley leading from watershed to Yun-chau, showing former alluvial deposit; (61) Yun-chau from the east; (62) Sha-ho-bin, valley of the Yun-chau river, below Yun-chau; (63) Shunning-fu from the main gate; (64) Inn at Yun-chau; (65) The usual crowd, Shunning-fu temple; (66) Captain Watts-Jones's room in Shunning-fu temple; (67) Innkeeper and sweetmeat-sellers at Yun-chau; (68) Rice terraces, Shunning-fu valley; (69) A country bridge recently erected by public subscription, Yung-chang-fu road; (70) Bridge in Shunning-fu valley; (71) Granite slab bridge in Mung-lang valley; (72) Public bath house, Munglang; (73) Sunday morning, the interpreter acts as barber; (74) Lolo children, Hei-kau-lin; (75) Lolo women, Hei-kau-lin; (76) A Chinese lady travelling; (77) Pony eating sugar-cane; (78) The Lolo uplands north of Kung-lung; (79) Valley of the Mi-tu stream; (80) Mi-tu plain from summit of Chao-chu pass; (81) Group of temples outside Mi-tu; (82) The south end of Tali-fu lake; (83) Taking building timber to Hsia-kwan market; (84 and 99) A side lagoon of the Tali-fu lake; (85) The north end of the Tali-fu lake; (86) Entrance to a merchant's house, Hsia-kwan; (87) Hsia-kwan market; (88, 90, 104, and 105) Drawing in the net, Tali-fu lake; (89) Stone slab bridge; (90) Going to market, Hsia-kwan; (91) North gate of Tali-fu; (92) Going to market, Tali-fu; (93) The Yin-mu-ho firm, Hsia-kwan; (94 and 95) The vegetable market, Hsia-kwan; (96) Timber market, Hsia-kwan; (97) Children playing on floating timber, Ma-chu-i; (100) Fishing-boats, Tali-fu lake; (101) A

timber ship, Tali-fu lake; (102) Tali-fu lake, "Stand by to lower away;" (103) A youthful navigator, Tali-fu lake; (106) A fortified village; (107) An afternoon nap; (108) Head of the irrigation canal, Ming-chita-ho river; (109) On the bank of the canal; (110) Gorge between Ea-sai and Lang-kung-hsien plains; (111) Bridge over the canal; (112) Bridge over outlet of Chen-chuan-chu lake; (113) Aqueducts over outlet of Chen-chuan-chu lake; (114) Outlet of Chen-chuan-chu lake; (115) Yangtse river at Shih-ku; (116) Stone drum at Shih-ku; (117) Li-chiang peak, from south end of plain, elevation 18,000 feet; (118) Li-chiang peak, from middle of plain; (119) Li-chiang peak, from Li-chiang-fu; (120) The La-chi-pa plain and lake; (121 and 122) Li-chia women; (123) A poor man's house, Li-chiang-fu plain; (124) Chou-yang-su temple: the goddess and attendants; (125) Chu-yang-ssu temple, interior; (126) Entrance to Chu-yang-su temple; (127) The Me-kong, looking upstream from the Yun-chau Tali-fu road; (128) Si-chiang ferry over the Me-kong; (129) Ferry over the Me-kong; (130 and 131) Getting mules into the ferry-boat, Chin-chiang-kai; (132) Village of To-mei; (133) Crossing the Yangtse river; (134) Getting mules out of the ferry-boat; (135) Types, To-mei market; (136) To-mei market; (137) A French priest and part of his congregation, Pien-kio; (138) Landlady of a roadside tea-house, Yun-nan-hsien plain; (139) Goats crossing outlet of Yunnan-fu lake; (140) Sheep crossing outlet of Yunnan-fu lake; (141) Pit bank at Ma-kai, the westernmost coal-field of Yunnan; (142) On the wall of Tsu-hsiung-fu; (143) Lachman Jadu, surveyor, (144) Ram Sahad, surveyor, and his henchman; (145) Criminal carried in a cage; (146) Official carried in a chair; (147) A typical village of Central Yunnan; (148) Near Ma-lung-chau; (149) The red clay uplands of Eastern Yunnan; (150) View in Swen-wei; (151) Garden of the Buddhist convent where we lodged, Swen-wei; (152) Ferry over the Ko-tu river; (153 and 154) A Chinese punch and judy show; (155) In the purple sandstone country; (156) Water-tower, Hêng river valley; (157) The eastern tower of Wei-ning; (158) Lolos near Wei-ning; (159) On the Wei-ning plateau; (160) From Chao-tung to Wei-ning; (161) Ta-kuan-lao; (162) Gate on the Lao-wa-tan road; (163) A peep at the foreigner, Ta-kuan-lao; (164) A steep bit, Hêng river gorge; (165) Looking up the Hêng river from below Huang-go-chi; (166) Inn at Ta-kuan-lao; (167) Looking up the Hêng gorge from Ta-kuan-lao; (168) Huang-ching-pa; (169) Looking up the Hêng gorge from below Ta-kuan-lao; (170) Cliff above Tu-sa-kwan from upstream; (171) Cliff above Tu-sa-kwan from Tu-sa-kwan; (172) The end of the land journey, mules and mulemen of Captain Watts-Jones's party; (173) Coolie carrying three bales of cloth; (174) Coolie carrying white wax insects; (175) A twenty-ton cargo junk and small passenger junk; (176) Resting between rapids; (177) Lao-wa-tan to Sui-fu, mile 855; (178) An average bit of country; (179) Shooting a rapid, side road; (180) Shooting a rapid, main road; (181) In quiet water; (182) T'an-ton, mile 878; (183) Puerh-fu, mile 869; (184) Lao-wa-t'an to Sui-fu, mile 882; (185 and 187) Portaging at Hsin-tan; (186) Below Hsin-tan; (188) Ploughing a ricefield; (189 and 194) A river-side village; (190) Sui-fu; (191) A market boat; (192) Bound upstream; (193) A ferry; (195) On the beach; (196) View from where Captain Watts-Jones sat in the boat; (197 and 198) Junks at Ho-chiang-hsien: (199 and 200) Limestone gorge above Chung-king; (201) A lighthouse on the Yangtse; (202 and 203) A river-side town; (204) View on the Yangtse river; (205) The bow of a boat from the stern; (206) Typical view on the Yangtse river; (207) Upper end of Fu-chau; (208) The stern of a boat from the bow; (209) A river-side town; (210–212) "Between horizontal strata of red sandstone;" (213) View above Wan-hsien; (214) A tributary stream of the Yangtse river; (215) The landslip forming the new rapid, upper edge of slip; (216) The landslip forming the new rapid, face of slip; (217) Below the new rapid; (218) Bound upstream; (219) The long straight reaches; (220) Six men to the bow sweep; (221) An overfall of the bank; (222 and 223) Wan-hsien to Kwei-chu-fu; (224) The Wind-box gorge; (225) Kwei-chu-fu; (226) A pinnacle in the Wind-box gorge; (227) Below the Wind-box gorge; (228) Side ravine in the Wind-box gorge; (229) Lower end of the Wind-box gorge; (230) Kwei-chu-fu to Ichang; (231) Bridge on the towing-path; (232) Sailing upstream through the gorges; (233) Junk and tender; (234) Junk sailing upstream; (235) Japanese gunboat on the lower Yangtse river; (236) Pinnacle in the I-chang gorge; (237) Village in the gorges; (238) A fifteen-ton junk.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

The

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COMMEMORATION OF THE REIGN OF QUEEN ELIZABETH.

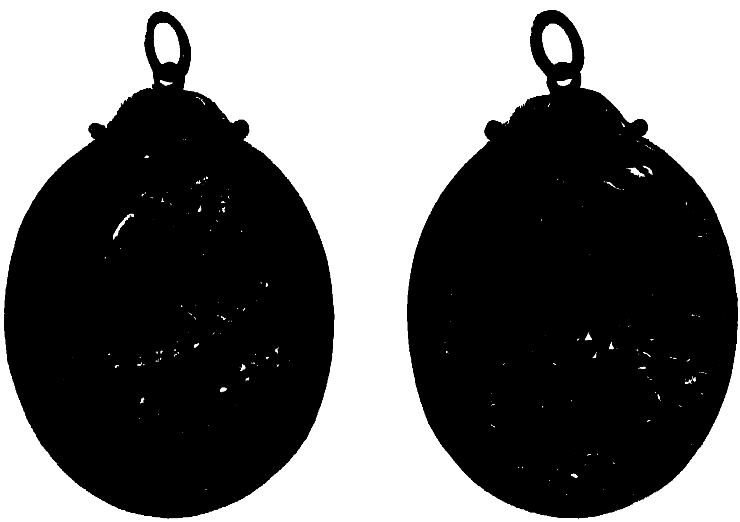
THE meeting of the Society on March 23 was devoted to the commemoration of the great geographical and exploring enterprises of the reign of Queen Elizabeth, in connection with the tercentenary of her death. Addresses were given by the President, Mr. Edmund Gosse, Mr. Julian Corbett, and Prof. Silvanus Thompson. At the same time there was an exhibition of books, maps, atlases, portraits, instruments, medals, and other objects relating to the great enterprises of this reign, many of them being kindly lent by public institutions and private individuals. The following are the addresses which were given at the meeting:—

I.

Address by the President, Sir CLEMENTS R. MARKHAM, K.C.B.

Let us not forget. On this tercentenary of the death of Queen Elizabeth especially, let us not forget that the beginnings of nearly every department of our science date from the labours of Elizabethan worthies. A geographer should know the history of each branch of his work, tracing its advances from generation to generation, and keeping in memory the beginners and the improvers whose work we inherit. A commemoration such as the one for which we are assembled this evening is intended and, I think, calculated to renew such knowledge, to freshen such memories. An accomplished writer has very truly said that "much interesting and even precious intellectual treasure is continually being lost through forgetfulness, and becomes again new if faithfully set forth once more." Our work to-night is faithfully to set forth the beginnings of our science during the great Queen's reign, that their history may not be forgotten, but become again new.

Queen Elizabeth was the fortunate sovereign of our first great discoverers and explorers, of our first really eminent compiler of voyages of discovery and exploration, of the enlightened and munificent promoters of geographical research, of our first accurate cartographers, of the authors of our first navigation books, of our first instrument-makers, of our first magnetic observers, of all those who laid the foundations of English geography on a scientific basis. There were several causes for this extraordinary activity during the memorable reign we commemorate, but the personality of the Sovereign, and the affectionate devotion she inspired, were, I am certain, not the least among these causes.



THE "ARMADA MEDAL." STRUCK BY QUEEN ELIZABETH TO COMMEMORATE THE DESTRUCTION OF THE SPANISH ARMADA, JULY 29 TO AUGUST 7, 1588.

The names of the great Queen's explorers and discoverers are still household words among us after three centuries—Raleigh and Humphrey Gilbert, Hawkins, Drake, and Cavendish, Burroughs, Frobisher, and Davis, and Lancaster; and among travellers by land, Jenkinson and Fitch. There were many others, but these stand forth pre-eminent. Sir Walter Raleigh's services will be in abler hands than mine. Sir Humphrey Gilbert, the distinguished soldier and advocate of Arctic discovery, was an Eton boy. He founded the first British colony, and his memorable last words were a fitting close to an heroic life. They shed a lustre on the annals of his country, and on the annals of his old school. Another Eton boy, to be mentioned directly, did good work for geography in Queen Elizabeth's time.

To Sir John Hawkins and his son Richard we owe the voyages to the coast of Guinea, to the West Indies and Florida, to Magellan's strait, and the west coast of the Pacific. But we owe much more. Sir John was an honest public servant and a diligent reformer. He put a stop to many abuses as treasurer and comptroller of the navy, and of course made enemies; but he never lost the Queen's confidence. Aided by Drake, he instituted a fund for wounded and worn-out sailors, which was long

SIR JOHN HAWKINS
(From a wood engraving)

known as the "Chest at Chatham." Sir John Hawkins was one of the best of Elizabeth's great sea-captains. He was a thorough seaman, and an able and upright administrator. Endowed with great courage and unfailing presence of mind, "he was merciful," says Maynard, "apt to forgive, and faithful to his word." His son Richard was a true chip of the old block. His 'Observations' show that he was something more than an explorer. They are full of shrewd remarks on all that appertains to a ship and its furniture; and, above all, they show the thought he

gave and the care he took for the health and comfort of the sailors. Both father and son were splendid types of English maritime explorers.

The deeds of a still greater seaman, Sir Francis Drake, will be dealt with presently by an abler hand than mine; then we have Thomas Cavendish, the second circumnavigator, and the Arctic voyagers, Frobisher, Burroughs, and Davis, who first introduced their countrymen to floes and icebergs, and described the perils of ice-navigation. Frobisher made three voyages to the land on the west side of Davis strait, which the Queen named "Meta Incognita." Burroughs was not only a polar explorer, but also an excellent hydrographer, and a scientific student of astronomy and magnetism. The discoveries of John Davis are shown on the Stockholm chart more particularly. They led directly to further discoveries. What he called his "Furious Overfall" lighted Hudson into his strait, and his famous cliff known as "Sanderson's Hope" lighted Baffin into his northern bay. Davis also was a scientific seaman and pilot, as well as a discoverer. He wrote the 'Seamen's Secrets,' and invented the back staff, and he piloted the first fleet of the East India Company round the Cape. James Lancaster of Basingstoke was another great sea-captain, the first to round the Cape of Good Hope, and the commander of the first fleet of the East India Company.

Elizabeth's travellers by land exceeded, in the length and importance of their journeys, all Englishmen that had gone before them. Anthony Jenkinson, crossing Russia from the White Sea, reached the Caspian, Persia, and even far away Bokhara. Ralph Fitch was England's pioneer to India. He crossed the peninsula, had an interview with the great Emperor Akbar, to whom Queen Elizabeth had sent a letter, and even visited Burma and Malacca. Nor should his fellow-traveller, John Newbery, be forgotten. He combined energy and courage with prudence, and was a splendid type of an Elizabethan Englishman.

The Queen's adventurous sea-captains and land-travellers form an unrivalled gallery of discoverers and explorers. But not less worthy to be remembered is the indefatigable recorder of their labours, Richard Hakluyt, the personal friend of most of them, the hearty well-wisher of all.

Elizabeth was the re-organizer of Westminster School, and she watched the progress of that "fruitful nursery" of great men with maternal care. Dean Goodman was her special choice. Camden, the most eminent topographer of her reign, was Head Master. When, in 1564, the Queen went to the Dean's house to see the Westminster boys act a Latin play, young Richard Hakluyt was one of those boys. The armour was lent by Secretary Cecil, the dresses came from the Revels; but this was years before there was any theatre or company of grown-up actors. Besides Latin plays performed before the Queen, young Hakluyt's great delight was the study of geography at his cousin's

rooms in the Middle Temple. He learnt things about geography which, he tells us, were of "high and rare delight to his young nature." Geography completely fascinated him while at Oxford, and he clearly saw the two great needs of his country. The first was caused by the ignorance of our seamen as regards the scientific branch of their profession. The second was the absence of records, and the way in which important voyages and travels were allowed to fall into oblivion. For

SIR MARTIN FROBISHER
(*From a wood engraving.*)

instance, not a single line of writing by John Cabot had been preserved. Hakluyt set to work, on leaving Oxford, with patriotic zeal to remedy these evils.

He began by delivering lectures on the construction and use of globes, maps, and nautical instruments, "to the singular pleasure and general contentment of his auditory," he tells us. He strove to get a permanent lectureship established "as a means of breeding up skilful seamen and mariners in this realm." His first work, entitled 'Divers Voyages touching the discovery of America,' was published

in 1582. This book was the first impetus to colonization. But the great work of his life, the 'Principal Navigations,' did not appear in its completed form until 1600. It is a monument of useful labour. It not only gave a stimulus to colonial and maritime enterprise; it inspired our literature. Both Shakespeare and Milton owed much to Hakluyt's 'Principal Navigations.' Our Westminster boy, as the years rolled on, continued "to wade further and further in the sweet studie of geography" until he achieved his great work, which was, in his own words, "to incorporate into one body the torn and scattered limbs of our ancient and late navigations by sea." Hakluyt has ever since been a rich mine of information for all inquirers; and in a few years I hope that we shall have our old friend reprinted in a series of handy and portable octavo volumes, for everybody to read and enjoy.

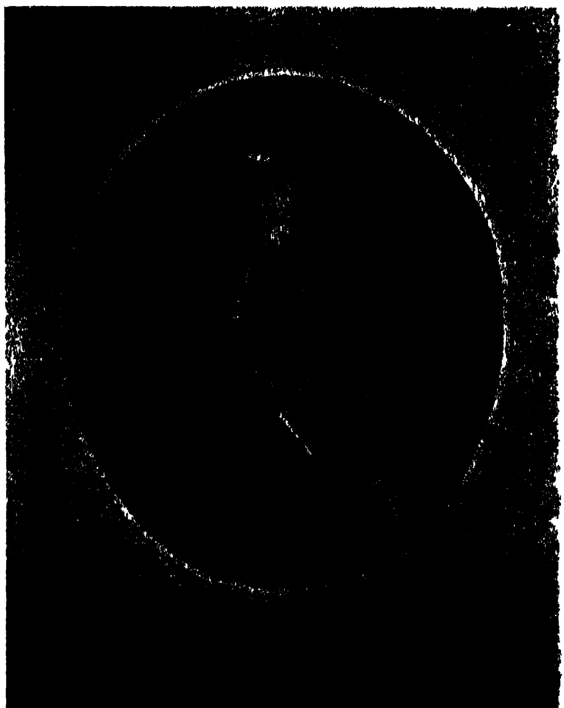
Hakluyt and Sir Walter Raleigh were the two principal promotors of the colonization of Virginia, therefore of the foundation of those colonies which eventually formed the United States of North America. For Virginia was then the whole of North America, except Florida and Norumbega; and Elizabeth, as we know from the title-page of Spenser's 'Faerie Queene,' included among her titles that of Queen of Virginia. Hakluyt, among his many and great services, led the merchant princes of that memorable reign to become the munificent patrons of maritime enterprise and of geographical research. Their names should ever be had in honour, and the chief among them should have a place in any commemoration of Elizabethan geography.

These Elizabethan merchants felt that they could not better serve their country than by despatching exploring expeditions and advancing geographical science. Sir Thomas Smith was one of the most eminent. He was an active member of the Muscovy Company, and was an adventurer for the first voyages to Spitsbergen. He took a leading part in the foundation of the East India Company, and was its first governor. He was ever mindful of Arctic discovery, and was the first governor of the North-West Company, gathering round him several other generous patrons of geography. His name was given by Baffin to Smith Sound, one portal to the polar ocean. But Sir Thomas Smith was not only an encourager of exploration; he also promoted the interests of the scientific branches of a seaman's profession, yielding to the persuasions of Hakluyt. Lectures on navigation were delivered at his house in Philpot Lane by Dr. Hood and by Edward Wright.

Other great patrons of geography were Sir George Barne, an adventurer of the Muscovy Company, who was at a meeting in Dr. Dee's house at Mortlake when John Davis's Arctic voyage was discussed, and whose descendant, Michael Barne, is now serving in the Antarctic Regions; and Sir Edward Osborne, the founder of the Levant Company and patron of the journeys to India, whose romantic story is so well known to us all. But there were many more, and the patriotic munifi-

cence of her merchant princes, in fitting out voyages of discovery, is one of the glories of Elizabeth's reign.

We must remember one other geographically minded merchant, Mr. William Sanderson of the Fishmongers' Company. He was the munificent patron of the Arctic voyages of John Davis, and all northern explorers who are fond of guillemot soup will remember him in connection with the great loomery on the perpendicular cliff which was



SIR RICHARD GRENVILE.

(From a wood engraving by E. Harding.)

quaintly named by Davis, "Sanderson his hope of a North-West Passage."

Sanderson also paid for the construction of the famous Molyneux globes, one celestial, the other terrestrial, which are embellished with his coat-of-arms, and dedicated to the Queen. This is what he wrote upon them—

> "Lo, at my charge thou seest the ever-whirling sphere,
> The endless reaches of the land and sea in sight appeare,

For countries good, for worlde's behoof, for learnings furtherance,
Whereby our virtuous Englishmen their actions may advance,
To visit forraine lands where farthest coasts do lye,
I have these worldes thus formed, and to worldes good apply."

"And to worldes good apply." This is, I believe, the secret of England's greatness. Other peoples work for their own "countries' good." England alone has ever worked for "countries good" *and* for "worlde's behoof." The globes, which you will see in the next room, were finished in 1592. They created a great sensation among scientific men. Manuals for their use were published by Dr. Hood, and by Robert Hues in his 'Tractatus de Globis et eorum usu,' as well as by Blundeville in his Exercises. For it must be remembered that, before the use of logarithms, seamen were accustomed to work out their astronomical problems on globes—a most excellent method, in use, I believe, for instruction even now by our map curator, Mr. Reeves. It enables the mind of the student to conceive the great triangles in the celestial concave by which the problems of nautical astronomy are solved. John Davis said that "the use of the globe is of great ease, certainty, and pleasure—of all instruments it is the most rare and excellent."

This brings us to the Elizabethan maps, and first to that famous map of the world, which, in *Twelfth Night*, Shakespeare called—

"The new map with the augmentation of the Indies."

It is the first English map on the so-called Mercator's projection. But it is really Edward Wright's projection. The Cambridge student made a voyage with the Earl of Cumberland, and thus applied the test of practice to his theories. This led him to turn his attention to the improvement of charts then in use; and the map of Mercator first suggested to him the correction of the many and grave errors in charts by increasing the distance of parallels from the equator to the pole. "But," says Wright, "the way how it should be done I learnt neither of Mercator nor of any one else." In 1594 he discovered the true method of dividing the meridian, and his table of meridional parts was published by his friend Blundeville in the same year. His own work, entitled 'The Correction of certain errors in Navigation,' explained the principle of the division of meridians, the manner of constructing tables of meridional parts, and their use in navigation. Before Wright's calculation of the tables, Mercator's projection was practically useless. Afterwards it became most valuable, and was soon in general use. The first map on Wright's principle, like the Molyneux globes, attracted much attention. It was well covered with rhumb lines, and not very well engraved, for engraving was still in its infancy in this country. In Shakespeare's play of *Twelfth Night*, Maria says of Malvolio—

"He does smile his face into more lines than are in the new map with the augmentation of the Indies. You have not seen such a thing as 'tis."

There is also an allusion to the Dutch discoveries under Barents on the coast of Novaya Zemlya, which first appeared on Wright's map. Fabian says—

> "You are now sailed into the north of my Lady's opinion; where you will hang like an icicle on a Dutchman's beard, unless you do redeem it by some laudable attempt, either of valour or policy."

And this allusion to Barents is an occasion for recording the great interest taken by Queen Elizabeth in the progress of Arctic discovery.

SIR WILLIAM SANDERSON.

(*From a wood engraving.*)

She ordered Sir Francis Vere, her general in the Low Countries, to keep her informed on the subject as regards Dutch enterprises; and the result of this order was a very fair account of the discoveries made by William Barents, from Sir Francis, in a letter to the Queen.

The Molyneux globes and the first chart on Mercator's projection were landmarks in the cartographic history of the Queen's reign, but they by no means stand alone. Very memorable is the survey

undertaken by Saxton, of England and Wales, under the auspices and protection of the Queen. It was the first field survey, the forerunner of the Ordnance Survey. The final result was the atlas, with a fine portrait of Queen Elizabeth on the frontispiece, beautiful copies of which will be seen in our collection. Saxton was followed by Speed the historian, whose atlas was based more or less on Saxton. The survey of Saxton is also the basis of Edward Sheldon's curious tapestry large-scale maps of the midland counties, woven by Flemish workmen brought over by Sheldon, and established at Barcheston. Two of these maps are at York, and two in the Bodleian. Their date is about 1588. It will be remembered that Mr. Bedford exhibited the York maps at one of our afternoon meetings in 1896.

Charts for use on board ship, and particularly for expeditions of discovery, were specially drawn by hand by experts, and were on a large scale. Their provision depended on a knowledge of former work, and their construction required a good acquaintance with the principles of nautical astronomy, as then understood, and with the use of instruments.

The need had arisen for the best navigation books and improved instruments, both for the map-maker and the explorer. At first there were translations only. Ashley translated the 'Mariner's Mirror' from the Spieghel of Wagenaar; and the Spanish navigation books of Medina and Cortes were translated into English by Frampton and Eden. But soon our English scientific geographers began to produce original works. Cunningham's 'Cosmographical Glasse' appeared as early as 1559.

The value of the contents of English navigation books kept pace with the inventions connected with instruments for observing the heavenly bodies at sea. William Bourne, of Gravesend, in his 'Regiment of the Sea,' insists upon the duty of a captain of a ship to have knowledge, not only of charts, but also of instruments to take the height of the sun or stars. Nor were our Elizabethan sailors slow to seek instruction in the scientific branches of their profession. Bourne describes the use of the astrolabe and cross-staff; but his book, published in 1577, is chiefly interesting because it is the first in which the method of ascertaining the rate of a ship by means of the log and line is described. Humphrey Cole, the engraver and instrument maker, had, even at an earlier date, invented some plan for measuring the rate, analogous to Massey's self-registering log.

But the leading lights in Elizabethan nautical astronomy were Hues and Hariot, and somewhat later Briggs and Gunter; and it is worthy of note that most of them had their wits sharpened by long sea-voyages before they buckled down to their studies. Robert Hues had made a voyage to Virginia, and had knocked about with Cavendish in the Straits of Magellan, before he sat down to explain all the problems that

can be solved by the use of a globe. Thomas Hariot had made two voyages across the Atlantic to Virginia before he wrote his great work on algebra, and applied the telescope to observations of Jupiter's satellites, simultaneously with Galileo. Hariot, says Dr. Wallis, laid the foundation without which the whole superstructure of Descartes had never been. Edward Wright made a voyage against the Spaniards with the Earl of Cumberland before he calculated his table of meridional parts and constructed his famous map of the world.

SIR THOMAS MIDDLETON

(From a steel engraving by W. Bond of a painting by J. Allen, at Chirk Castle.)

But perhaps Briggs and Gunter were the greatest of the Elizabethan scientific geographers. For the discovery of logarithms by Napier made a complete revolution in the science of navigation, and Briggs and Gunter brought the discovery into practical use. Briggs went through the gigantic labour of calculating his tables of logarithms of natural numbers. No greater service has ever been done by one man for navigation, and Luke Fox did well to immortalize it by naming an island in Hudson's Bay "Mr. Briggs his Mathematics."

Edward Gunter was a Westminster boy, like Richard Hakluyt, and was elected to Christ Church. He worked with Briggs at Gresham College, and while the former devoted his time to natural numbers, Gunter completed the tables of artificial sines and tangents. He invented and first used the terms cosine and cotangent. Gunter was also the inventor of the Gunter's scale, which we all know well, of the Gunter's chain, of a new quadrant, and of an improved cross-staff.

I have mentioned two Westminster boys, Hakluyt and Gunter. I must not forget Eton. Besides Sir Humphrey Gilbert, William Oughtred was an Eton boy. He was an eminent mathematician, and invented a very useful instrument called the "horological ring," two or three examples of which may be inspected in our exhibition.

It will thus be seen with what diligence and perseverance, with what zeal and enthusiasm, the men of science worked at the preparation of manuals, the construction of maps, and the improvement of instruments in order that the labours of their brethren in the field might be more useful, more accurate, and less perilous. Magnetic observations were also commenced in this reign; but there is a master of that subject present with us, who will presently contribute a short address to our commemoration.

At last, after near upon half a century, the memorable reign drew to a close. This evening, three centuries ago, the great Queen was speechless. Most of her early contemporaries had already passed away. Yet she was still surrounded by relations and affectionate friends. Her most trusted cousin, the great Admiral, was with her to the last. Beautiful Margaret Willoughby was one of the maids of honour to the Princess Elizabeth at Hatfield. Often she might have been seen in those days, in gay attire, in the balcony at Hatfield, talking and laughing with divers in the courtyard. Years rolled on, but her devotion to her beloved mistress did not diminish. As the widowed Lady Arundell, she attended her Queen and life-long friend on her death-bed.

And so, in the midst of her greatness, with many of those who had grown up during her reign still in full activity, full of patriotic schemes and scientific inventions, the great Queen passed away. But the work of her reign lived. The science of geography in England was planted on a firm basis, to grow and thrive. The impulse survived too, and the Elizabethans—the men born and bred in her reign—continued to produce valuable work, to perform great deeds, for twenty and more years at least after her death.

The roll of Elizabethan work, to quote myself in another place, "is indeed a roll of surpassing splendour. In the far north, the 'Meta Incognita' and Davis Strait discovered, and the intercourse with Russia by the White sea strengthened and organized. The Caspian Sea navigated and Bokhara visited. India and Burma made known. A great

fishing-trade established on the Newfoundland banks. Virginia discovered, and a sure foundation laid for the future colonies which were to form the United States. The charter granted to the Turkey Company, and British trade placed on a sure footing in the Levant. Lucrative trade on the coast of Guinea, in the West Indies, and on the Spanish main kept alive by English cruisers. The Orinoco explored as far as the mouth of the Karoni. The world twice circumnavigated. Cape Horn and 480 miles of the west coast of North America discovered.

SIR DUDLEY DIGGES

(From a steel engraving by C. Turner.)

The Cape of Good Hope first rounded by English ships: and a charter of incorporation was granted to the East India Company, which opened the first chapter of the British Empire in India.

"One of the results of Elizabethan exploration and discovery was the extension of British commerce in all directions to the remotest corners of the Earth. Another result was to stimulate, in the highest degree, an enthusiastic feeling of patriotism which no difficulties or hardships could daunt, and no disaster could quench." But for us

this memorable reign should ever be remembered as the time when geography, in all its branches, was fostered and advanced, and when our science had a commencement whence it has continued to grow and increase to the prosperous condition in which it came into our hands. But we must remember that much remains to be done. We can learn much—very much—from our Elizabethan predecessors; from those who penetrated into distant regions, as well as from those who devoted their talents at home to geographical research and to the improvement of geographical methods and appliances. From that point of view, it is well that we should, on such an occasion as the present, pass in review the geographical achievements of the subjects of the great Queen.

II. SIR WALTER RALEIGH.

By EDMUND GOSSE.

In the England which was controlled by that Virgin Queen whom we have met here to commemorate, there were two diametrically contrasted intellectual currents in active force. We are apt to forget the one, the prosaic and realistic tendency, which was represented in literature by domestic plays like those of Dekker, and by sober poetry like that of Daniel. It expressed itself in many practical forms of usefulness. It was so opposed to the picturesque that it averred there was nothing in the world more worth seeing than could be met with between Westminster and Staines. In public life this spirit found its perfect representative in Robert Cecil, that cold and crafty statesman who scorned and distrusted the exercise of the imagination wherever it confronted him. But at the side of this excess of common sense, and incessantly excited, and, as it were, burnished by resistance to it, there moved a class of mind which clothed the unknown in a robe of purple vapour, exalting, transfiguring, exaggerating all remote and unexperienced facts in a magnificent sunset light of glory. And the very prototype of this class of Elizabethan temperament was that paladin of geographical romance, Sir Walter Raleigh.

It is a remarkable tribute to the force and genius of Raleigh that he was recognized in his own age, and has been vaunted ever since as the patron as well as the prototype of geography as a form of imaginative literature. In the popular mind, to this day, he gets credit for what he planned and for what he wished to do, as well as for what he did. So pertinacious is the legend which connects him with Virginia, that I doubt if every one, even in this learned assembly, recollects that Raleigh never set foot in what we call North America. But in the events of 1583, in the epoch-making charter of 1584, in all that excited English sentiment in the settlement of those colonies from Martha's Vineyard to Florida, the moral influence of Raleigh was paramount. His nostrils

never snuffed the fragrant air which blew out into the Atlantic from North Carolina to meet the colonists; in his bodily presence he never touched those aromatic cedars of Wokoken, never tasted the wild grapes of Roanoke. But in spirit he was there through good and evil estate. His was the brain that planned, the persistence that carried out, the courage that would never relinquish the design. And the promised land of Virginia is his in history, although he only gazed at it from the fringes of the cloud.

SIR WALTER RALEIGH

(From a steel engraving by J. Houbraken)

Contempt of the cruel and ignorant Spaniard was always burning in Raleigh's bosom. He tells us that Berreo, though a finished hidalgo, and an experienced adventurer in Indian waters, could not distinguish between east and west. Raleigh had no such difficulty in finding his way across the seas. Vice-Admiral of the South-West, he was; and we seem to see him, in our mind's eye, sitting for hours on some promontory of Cornwall, and gazing, gazing across the shrouded ocean There is a pathetic and penetrating phrase in a letter Lady

Raleigh wrote to Cecil in February, 1594: "I hope, for my sake," she says, "you will rather draw Sir Walter east, than help him forward toward the sunset." That was all his dream; it was for that that he fretted against the coldness and the jealousy and near-sightedness of English statesmen. He longed for this one thing, and with such vehemence that thus and not otherwise posterity sees him, with straining eyes and beating heart, leaning forward towards the sunset.

At last he found his opportunity. In 1595, the man who had always been forbidden to go over to Virginia broke away to a still more romantic region—to the dim and magnetic wilderness of Guiana. He was stayed for a while at the last. "This wind breaks my heart," he wrote. I do not know in the history of the human mind anything more poignant than this fret and agony of delay, which was to be so constantly Raleigh's punishment. The hunting-dog sees and scents the quarry; it is within his reach in a couple of bounds; and always there is this galling and intolerable chain that cannot be slipped. But he slipped it at last in 1595, and he wrote that magnificent and romantic book, the very name of which is like the blast of a trumpet. Let me remind you of the spacious title-page of 1596: 'The Discovery of the large, rich and beautiful Empire of Guiana, with a relation of the Great and Golden City of Manoa, which the Spaniards call El Dorado, and the Provinces of Emeria, Arromaia, Amapaia, and other Countries with their Rivers adjoining.'

It is not needful that I should detail to you the contents of this wonderful volume, for it is your accepted classic in Elizabethan geography. But it is amusing to remember that a hundred and fifty years later all that Hume had to say about it was, "that it was full of the grossest and most palpable lies." Robert Cecil could not have said more when the book was written, nor the man in the street to-day. There is inexactitude in all historic records, and Hume himself is no longer cited for his accuracy. It is hard, it is perhaps impossible, to describe a cab-accident in which you have yourself taken part, without some deviations from the truth. Raleigh was told wonderful things of a tribe of Indians whose eyes were in their shoulders and their mouths in the middle of their breasts, and of another "who have eminent heads like dogs, and live all the daytime in the sea." In such cases as these, we know that he was himself deceived; he did not understand what it was that his interpreters were endeavouring to impress upon him. But we no longer commit the vulgarity of supposing that he set himself to fill out his narrative with "the grossest and most palpable lies." He was ignorant of many things that a child knows now, and his ardent curiosity made him credulous. But in all which he reports from personal experience, the wonder is that in that tropic air his intellect could hold its own as soberly and coolly as it did.

He represents to us, he will always represent to successive generations,

the man who travels, not to lay the foundations of experience, but to set a pinnacle on the finished edifice of his culture. Into the sunset Raleigh took an intellect which was one of the most powerful and most highly trained of the rich Elizabethan age. He was poet, historian, chemist, soldier, philosopher, courtier; he carried with him on his geographical expeditions the prestige, the skill, the basis of ripe thought which all this commerce with the world of men and books had given him. His aim was not merely adventure; it was not merely the picturesque enjoyment of a queer land full of pineapples and parakeets and armadillos. It was not even the desire to find gold for himself and an empire for his Queen, that inspired him. "He shot at another mark than present profit," and he stands for all time as the most splendid example of the geographer and patron of geographical literature who approaches his science in the pure light of imagination.

III. FRANCIS DRAKE.

By JULIAN CORBETT.

In speaking of the glories which Sir Francis Drake added to the reign of Elizabeth, one is confronted with a serious difficulty. They were so many and so great, and for that reason I think I can do no better to-night than confine myself to the greatest of them all. For Drake enhanced the splendour of Elizabeth's reign with one of the four great discoveries of the world. Those four, I think I may say, were the discovery of the Cape of Good Hope, the discovery of America, the measuring of the Pacific by Magellan, and, fourthly, the discovery of Cape Horn, or, in other words, that the Pacific and the Atlantic were undivided. Let us consider for a moment what that meant. The age of enterprise had begun; the desire to find out the ends of the Earth was on fire; Europe was reaching to the west, and across her path from pole to pole was supposed to stretch a mighty continent in the hands of Spain. At no point could it be passed except by the strait which Magellan had discovered lying between the two halves of that great continent, between Peru on the north, and on the south what was then called the Terra Incognita, or Tierra del Fuego. It was felt by every one that so long as Spain was in that position, closing the Pacific against the world, little advance could be made. Drake sailed with the intention of forcing the barrier, but not with any idea or hope of breaking it down. He sailed with the idea of passing the straits as Magellan had passed them. It was an accident of his voyage, partly due to the act of God, partly to his own consummate seamanship, that he did break the barrier down, that he removed the Terra Incognita from the map, and threw wide the gates of the Pacific to the world.

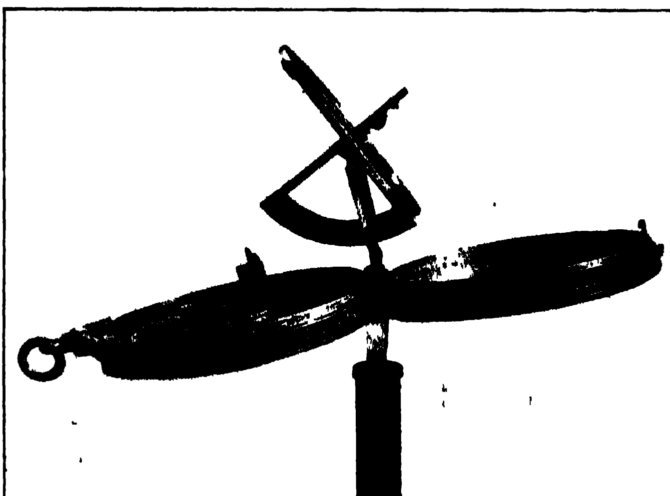
Another reason for dwelling on this exploit to-night is that the breaking of that barrier is generally attributed to some one else. It is attributed to the Dutch sea-captain Schooten and the geographer Lemaire. Now, the first thing that strikes one in reading the account of their discovery is that they refer to a previous discovery, which prompted them to undertake the venture, and it is impossible, as I hope to show you, that that reference relates to anything else but

SIR FRANCIS DRAKE.

(From a steel engraving of a painting by J. Houbraken.)

what Drake discovered. But that is not all. For even with the help of Drake's information, Lemaire did not come so near the truth as did Drake. Lemaire came home believing that he discovered, not the open sea which Drake had charted to the south of America but another strait like that which Magellan had discovered, a strait that lay between Tierra del Fuego and a land he called Staaten Land. He still believed his Staaten Land was part of a great continent that stretched away to the south pole, and that the only two known ways of passing into the Pacific were through Magellan's strait and the one he himself had found.

Now, I know it must strike every one as almost incredible that a discovery so great as the open sea south of America should not have been at once known to all the world, and at once credited to its author; so strange is this that it came to be doubted whether Drake had made the discovery at all. It is doubted sometimes even in our own day; at least, it is not recognized as one of the great, perhaps the greatest, achievements of an English navigator. The reason why it was not at once recognized has recently been revealed to us, but before dealing with this I should like to say a word on the evidence, which makes it perfectly clear that the discovery was a real one. We have first the minute account written by Drake's chaplain, who accompanied him on



ASTROLABE. CONSTRUCTED FOR SIR FRANCIS DRAKE PRIOR TO HIS FIRST EXPEDITION TO THE WEST INDIES, 1570, AND SAID TO HAVE BEEN PRESENTED TO HIM BY QUEEN ELIZABETH.

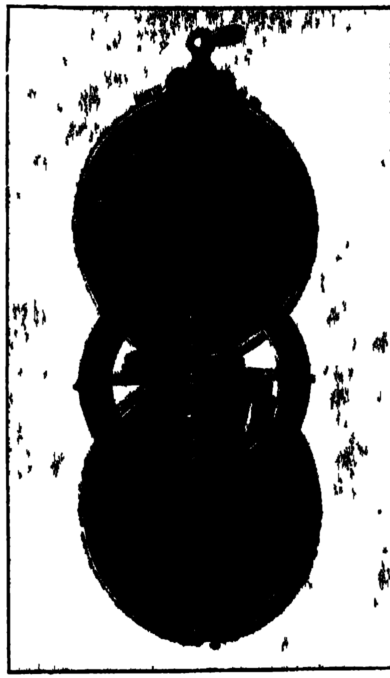
the voyage—Fletcher. He describes very clearly how, in the great storm which Drake encountered after he passed the straits, he was driven far to the south, how he was driven back to the straits, how he was driven to the south again, and then, being driven northward for the second time, found himself, not to the west of Tierra del Fuego, but to the east. Then, coasting along the islands in fair weather till he came to the most southerly of all, he landed. Fletcher describes how he too went ashore, taking with him his bag of instruments, and how he took the latitude, which he gives quite correctly. Fully alive to the gravity of the event, he further tells us that he set up a stone, engraved with the name of Elizabeth, and the year and the reign, to commemorate the discovery in her honour. That stone we cannot

hope to find, but there still exists in the British Museum the chart he made of the immortalized island. Drake also afterwards told Sir Richard Hawkins what he was doing while Fletcher was taking his observations. Drake sought out the most southerly point he could find, lay down, and grovelled out to the end of the rock, as Hawkins says, till his head hung well over, and then he came back laughing to his ship's company, and bragging that he had been farther south on land then known to the world than any man among them, or than any man who ever lived.

Well, in the face of that very detailed account we ought to be careful how we reject it. But this is by no means all the evidence. On no less than four maps before the end of the century that discovery was charted. We have first a silver placque, on which Mr. Christy has written an admirable monograph. There Drake's voyage is plotted, showing the islands at the south of America, with which he replaced the Terra Incognita, and a fairly open sea below. Then we have another well-known map, which was prefixed to Hakluyt's edition of Peter Martyr in 1587. It was apparently by the same hand; the two almost exactly agree. Thirdly, we have the map of Hondius, which, about the year 1595, he drew to celebrate the achievements of Drake and of Cavendish; and, lastly, we have the famous "New Map" which you have seen on the screen to-night. This is the map which Hakluyt finally adopted for the second edition of his voyages instead of the one by Molyneux, which he had intended to use; and it is very noteworthy that this rejected globe of Molyneux's still shows the antarctic continent stretching right up to America. We may conclude, therefore, that Hakluyt, after mature consideration, was thoroughly convinced of Drake's discovery, and the whole of Drake's discovery; for the "New Map" goes further than all the others, and shows a great open sea at the south of America, or, as Fletcher said, "the South Sea and the Atlantic rolling together in one great flood."

Those bases of evidence are probably fairly well known to most of the members of this Society; but I would venture to say there is another remarkable one which is not so well known, and which shows us clearly how it was that the discovery was not at once trumpeted to the world. It is a letter which the Spanish ambassador wrote in great alarm to Philip II. when he found out what Drake had done. You will remember that a year or two after the *Golden Hind's* return an expedition was set on foot under Fenton to take advantage of the treaties which Drake had made in the Moluccas to the advantage of the English against the Portuguese. There arose a discussion as to which way he was to go. There had been an effort to amalgamate the two schools of navigators, which we may call the Drake school, and the rest. There was a good deal of friction. Drake's men, with the pleasantest memories of what had happened to them before in the South

sea, were anxious to go west-about; the others, more peacefully inclined, wished to avoid a conflict with the Spaniards and go east-about. Drake was asked his opinion There is no English record of what it was; and we have to go to the Spanish ambassador, who was watching the preparations of this expedition and trying to find out what it meant. The day Fenton's instructions were signed he did find out, and he wrote off at once both by land and by sea to Madrid, and I would venture to read one or two extracts from that long and detailed letter.



DRAKE'S ASTROLABE SEEN FROM ABOVE

After giving particulars of Fenton's fleet, the ambassador says, "They are not going to the Moluccas by the Cape of Good Hope; they mean to make the port of St. Julian and go to the strait of Magellan, which Drake discovered to be no strait at all, and that there was no such continent as depicted in the maps and called Tierra del Fuego, as distinguished from Peru, but only very great islands and channels between them, the inlets being large, as the story goes" He then goes on to relate fairly accurately how Drake—partly by accident and partly by good judgment—was driven round the Horn and discovered the open sea. He then proceeds, "From this situation he judged that he might take what Magellan asserted was a strait to be islands, and that there was no continent, since he had beaten about it in a storm for fifty-four days without finding port. Wherefore, getting a good and fair wind, Drake returned to explore it outside the islands which appear to be a strait, and so came into the South Sea" Then he relates how, when Winter deserted and came home, he brought with him a similar story, but although, he said, "Winter asserted there was no strait, but only islands, he could not be believed till Drake returned"

He then gives us the solution of the mystery that overhangs the discovery. For he goes on to explain to Philip that for political reasons, only too obvious to the King of Spain, it was being deliberately suppressed. "Drake has not revealed the secret to any one," he writes, "but only to some of the council and some of the promoters of this

company"—that is, Fenton's company. "These men pointed out to him the danger of sending the ships when your Majesty had so large a fleet at the Straits of Magellan." (For Philip was then on the point of sending out a powerful expedition.) Drake replied, "So much the better, because your Majesty's ships, by keeping that station, will feel sure that nothing can pass into the South Sea, and in the end they will find themselves well tricked, because there is nothing but big islands and open sea in the direction of Tierra del Fuego." That was Drake's announcement of his discovery to the council. The ambassador goes on to say, "The person who gave me this information has seen the *carta* and the *platicallo*" (by which he probably meant what was always called the card and the plot by English navigators). Yet, from not being skilled in cosmography, he had not been able to report accurately the degrees. Nevertheless, he has no doubt, and he concludes by alluding to the boast of the English that they will go to the Moluccas and make annexations, as they please. "I send this information to you," he adds, "that you may understand the truth of this, which is considered as a certainty. Drake asserted it as such to these councillors, and it will be to your Majesty's service to instruct the Armada, which is going to the Straits of Magellan, to examine the whole situation thoroughly." From the Venetian ambassador at Madrid, who at once got hold of the information, and sent it on to Venice as a matter of grave importance, we know that this advice was acted on.

Thus we get the whole story and the explanation of the mystery that shrouded the English discovery of the Horn. For purposes of state, too complex to consider to-night, it was for some years kept a profound secret, and although in 1582 the secret was known both in Spain and Venice, it was not divulged to the world till the publication of the first two of those maps to which I have alluded, and which are believed to have been published in the year 1587 or 1586. That is to say, it was kept a state secret until Drake's expedition to the West Indies made war with Spain inevitable. This is the simple explanation. That it should have been divulged at such a moment was in itself suspicious, and the doubt was confirmed by the report which Cavendish brought home. He allowed himself to be misled by the remnants of the Spanish garrison which had been sent to occupy the straits. He made no attempt to ascertain for himself the truth or otherwise of Drake's discovery, but merely came back and said it was not to be believed. After Elizabeth's death, James's subserviency to Spain fully explains why the quest was not carried forward in his reign, but was left to Schooten and Lemaire to verify.

Now, I would venture to say that in the face of the evidence I have hastily outlined it is absolutely impossible to doubt the truth, and not only the truth, but the tremendous political importance of that discovery, an importance which was thoroughly recognized at the time.

The unity of the Atlantic and the Pacific is England's discovery, and England should claim it; she should claim it for Drake and his mistress, whose tercentenary we are celebrating to-night. It would be a bare act of justice—I fear it is quite impossible—but I say it would be a bare act of justice to those two great memories if henceforth we could call that cape, not "Cape Horn," but what Drake called it after his immortal and beloved mistress, "Cape Elizabeth."

NOTE.—The Spanish ambassador's letter is printed in the *Documentos Ineditos*, vol. 91. *Cartas de Don Bernardino de Mendoza*, April 20, 1582.

IV. WILLIAM GILBERT AND TERRESTRIAL MAGNETISM.

By Prof. SILVANUS P. THOMPSON, F.R.S.

William Gilbert, the father of electrical science, was born in Colchester in 1540. Educated at St. John's College, Cambridge, where he took his degree as Doctor of Medicine in 1569, he settled, after four years of foreign travel, in London in 1573, and was admitted to the Royal College of Physicians, of which he became Censor, Treasurer, and, in 1599, President. He was in February, 1601, appointed personal physician to the Queen, whom he attended in her last illness. He came of a well-known East Anglian family, and held extensive landed estates in Essex and Suffolk. He survived the Queen only eight months, dying November 30, 1603.

Gilbert's monumental work, the 'De Magnete,' published in 1600, marks an era in magnetic science. For some four hundred years the employment of the magnetic needle in navigation had been known both in Northern and Southern Europe. While it is possible that the primitive use of the loadstone may be ascribed to the Baltic, it is certain that the employment of a pivoted needle, and the addition of a rose of the winds as a compass-card, both originated in the Mediterranean. The pivoted needle is described in the Epistle of Peter Peregrinus, written in 1269; while the earliest known compass-card marked with the initials of the names of the winds is that ascribed to Andrea Bianco, of 1426, in the Biblioteca Marciana in Venice. The manner of use in Elizabethan times of the loadstone and of the compass may be gathered from Olaus Magnus ('Historia de Gentibus Septentrionalibus,' 1555), from Pedro de Medina ('Arte de Nauegar,' 1545), Martinus Cortes ('Breve Compendio de la Sphera,' 1556), Blundevile ('Exercises,' 1594), Norman ('Newe Attractive,' 1581), Borough ('A Discours of the Variation of the Cumpas,' 1581), Pedro Nuñez ('Instrumenta Artis Navigandi,' 1592), Barlow ('The Navigator's Supply,' 1597), Nautonier ('Mécometrie de l'Eyman,' 1602), and Stevin ('Die Havenvinding,' 1599).

At the time when steering by the compass was introduced into navigation, the compass pointed in Middle Europe so nearly truly to

the north that with the rough instrumental appliances at hand its deviation from the true north was seldom noticed, or, if noticed, ascribed to some error in the setting of the needle. Nevertheless, observations of the deviation were noted, and described as a "variation" or "declination," or a "coasting," or a "north-easting" of the needle. Later the compass-makers began to set their needles slightly askew beneath the card, according to the variation in the place of origin. Norman (1581) states that those used in the Levant, made in Sicily, Genoa, or Venice, had the needles straight, while those used in Denmark and Flanders had them set at three-quarters of a point, or a whole point, to the eastward; while those made in Spain, Portugal, France, and England, had the needles set half a point to the east. Those for Russia were set at "three seconds of a point." Gilbert denounced these devices as tending to obscure the true facts. Gradually it became recognized, probably after the voyage of Columbus, when the manifest change in the declination of the needle nearly caused mutiny of the sailors, that the direction of the needle really differs at different places; and accordingly navigators began to collect data. The record of the voyage of Columbus states that during his second voyage in 1496 he used for steering the observations made on the declination during his first voyage. The "secret" of Sebastian Cabot, which he declared when dying to be a divine revelation to him, can have been little else than the idea of using in navigation the local declinations of the compass. On the other hand, Pedro de Medina flatly denied the existence of the declination, adding that if the compass did not show the pole, the fault lay in the defective construction of the compass itself. Columbus had found a point 2½° east of Corvo, in the Azores, where there was "no variation," and other navigators explored the "agonic" lines which crossed the Atlantic and the Indian ocean. According to Humboldt, Alonzo de Santa Cruz in 1530 constructed the first general variation chart. But along with this development of practical interest in the subject there grew up a crop of wild legends to account for the irregularities observed. The reason why the compass needle pointed north, and the reason why it did not point truly north, were alike proclaimed to be due to the stars, to the influence of spirits, or to the existence of loadstone mountains of uncertain locality and of fabulous power. The old traditions of the Arabian Nights, dressed in a newer setting, found themselves justified by the insertion in maps of loadstone rocks, the position of which changed at the fancy of the chartographer. Ptolemy had located them in the Manioles; Olaus Magnus declared them to be under the pole; Garzias ab Horto situated them in the region of Calcutta. The map of Johann Ruysch, which adorned the edition of Ptolemy, published at Rome in 1508, showed four magnetic islands in the Arctic circle. Martinus Cortes placed the loadstone mountains in Sarmatia. Mercator in his great chart depicted

two great rocks rising from the sea to the north of Eastern Siberia, one being drawn on the supposition that at St. Michael the compass points due north, while the other is further north on the supposition that the compass points due north at Corvo. The map of Cornelius Wytfliet, 1597, shows the same phantom islands. Blundevile, writing in 1594 of the now lost map of Peter Plancius, mentions that he sets down the pole of the loadstone somewhat to southward of the islands that lie east of Groynelande.

Meantime another significant fact had been discovered* in 1576 by Robert Norman, of Limehouse, compass-maker, namely, the tendency

DR WILLIAM GILBERT

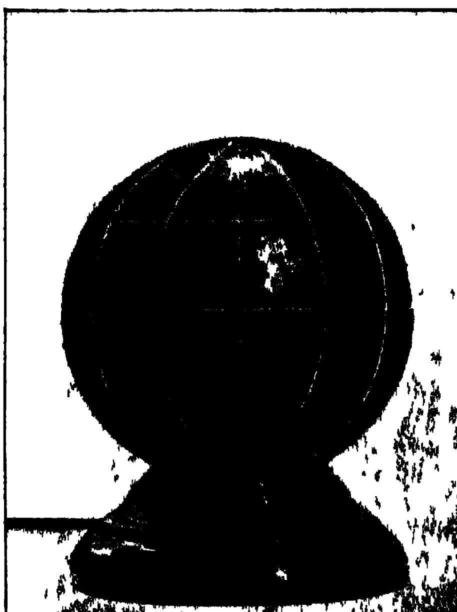
(From an electrotype medallion by F Dunckley)

of the magnetized needle to dip its northern end downwards Noticing this as a circumstance that occasioned him some trouble in the construction of his compasses, he thereupon devised a *dipping-needle*, and measured the dip, "which for this City of London I find by exact observations to be about 71° 50′." He attributed both the declination and the dip of the needle to the existence of a "point respective," which the needle respected or indicated, but toward which it was not attracted. The first authoritative treatise on the variation of the compass was the tract by William Borough, comptroller to the Navy, who in 1580 found an eastward declination of 11° 15′ at Limehouse. Borough had himself travelled in northern regions, and had found at Vaigats a westerly declination of 7°, whereas by Norman's theory of the respective point there should

* Also independently observed in 1544 by Georg Hartmann, of Nürnberg, but not published till later

have been an easterly declination of 49° 22′. The great navigators were continually bringing home fresh information. Drake, Lynschoten, Cavendish, Hariot all contributed; as did lesser men, such as Abraham Kendall, sailing-master to Sir Robert Dudley, the *soi-disant* Duke of Northumberland, and afterwards companion of Drake in his last voyage. Teachers of navigation such as Simon Stevin of Bruges, and Edward Wright, lecturer to the East India Company, might record and tabulate; but a master-mind was wanting to forge some larger and consistent doctrine which should afford a grasp of the whole subject. Such an one arose in Dr. William Gilbert. Nurtured, as we have seen, in the Cambridge which had so recently been the home of Linacre and of Kaye—the Kaye who founded Caius College—Gilbert had, during his subsequent sojourn in Italy, conversed with all the learned men of his time. He had experimented on the magnet with Fra Paolo Sarpi; he had, there is reason to think, met Giordano Bruno; he was the friend and correspondent of Giovanni Francesco Sagredo. Being a man of means and a bachelor, he spent money freely upon books, maps, instruments, minerals, and magnets. For twenty years he experimented ceaselessly, and read, and wrote and speculated, and tested his speculations by new experiments. For eighteen years he kept beside him the manuscript of his treatise, which in the year 1600 saw the light under the title of 'De Magnete,' to which was added the sub-title: 'magneticisque corporibus, et de magno magnete tellure, physiologia nova.' That which Gilbert had in fact perceived, and which none before him had glimpsed even dimly, was that the globe of the Earth itself acted as a great loadstone, and that the tendency of the needle to point in a polar direction was due to the globe acting as a whole. So he boldly put into his title-page the statement that his new philosophy was concerning *the great magnet the Earth*; and in chapter after chapter he set himself to describe the experiments upon which he founded his famous induction. The phrase *terrestrial magnetism* does not occur in any of the prior treatises, because the idea had not presented itself. Gilbert piled proof upon proof, sometimes most cogently, as when he constructed loadstone globes, or terrellas to serve as magnetic models of the Earth; sometimes with indifferent logic, as when he pointed to the iron ore in the Earth and reasoned that the magnet tended to conform to (*i.e.* turn itself toward) the homogenic substance of the body from which it had been dug. The local deviations of the compass he sought to account for by the irregularities of the Earth's crust, and maintained that the compass tended always, at places off the coast of a continent, to be deflected somewhat toward that continent. His syllogism was based on the fact that at that date all the way up the Atlantic seaboard of Europe, from Morocco to Norway, the variation was eastward. He argued that this was a universal law. But even within one generation, as may be seen in 'Purchas his Pilgrims,' in the narrative of the voyage

of Bylot and Baffin, the generality of the law was questioned. Gilbert reasoned on such knowledge as he had, and this did not include any notion of the secular changes in the declination. In his time, as he tells us, the variation of the compass at London was 11°. What he did not know was that this was a diminishing quantity which in fifty-seven years would be reduced to zero, to be succeeded by a westward declination that would last for nearly three hundred years. For the facts as known in the thirty years succeeding Gilbert's death, see the remarkable and scarce volume of Gellibrand: 'A Discourse Mathematical on the Variation of the Magnetical Needle' (1635).

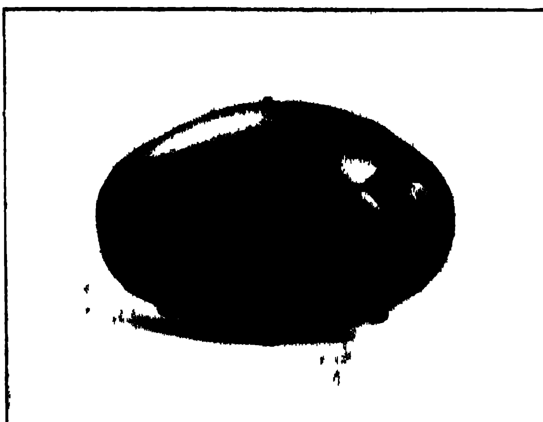


A TERRELLA.

Gilbert's treatise is a skilful literary achievement, in which there is no trace to reveal whether any part was written before the rest. It is divided systematically into six books. The sixth book only appears to suffer from some incompleteness. It relates not so much to the magnet as to the Copernican theory of the universe, which doctrine Gilbert had eagerly espoused, and which he was the first in England to proclaim. It is known from a letter to Barlow, printed in 1616, that he intended to add to it certain chapters descriptive of some of his instruments, but he had not completed these before his death. The first book treats of historic accounts of the loadstone, of its origin and properties, of iron

ores in general, and of the fables and vain opinions which in the hands of Paracelsus and of the schoolmen had grown up around the magnet. The second book is on the magnetic motions, and primarily on the attractions and repulsions between loadstones, between loadstone and iron, and between magnetic needles. In this book occurs the notable digression upon the subject of amber and the electric forces of amber and of other substances which when rubbed show, as he discovered, similar electrical powers. An analysis of this part, and a summary of Gilbert's electrical discoveries, will be found in the Notes printed for the Gilbert Club to accompany the English translation (1900) of the 'De Magnete.' After this digression Gilbert returns to the attractive properties of the loadstone, and to the way they are affected by giving it different shapes. In the course of this inquiry, he announces his discovery of the augmentation of the power of the loadstone by arming it with iron caps, an invention which caused Galileo to say, "I extremely praise, admire, and envy this author for that a conception so stupendous should come into his mind. I think him moreover worthy of extraordinary applause for the many new and true observations that he has made." Gilbert further pointed out that the loadstone is surrounded by a sort of atmosphere or "orbe of virtue" within which the magnetical effects can be observed. Book III., on the directive force of the magnet, is full of most instructive experiments, in which the terrella figures largely, relating to the question how one magnet influences another and tends to make it point toward it. All this was leading up to the theory of terrestrial magnetism; for we find him naming the parts of his loadstone globes with poles, equator, and meridians. In this book he dilates on the observation that vertical iron rods, such as the finial on the Church of St. John at Rimini, spontaneously acquired magnetic properties. This he traced to the influence of the Earth, and demonstrated the effect by magnetizing iron bars by simply hammering them on the anvil while they lay in a north and south position. A crude woodcut depicts this operation. Book IV. deals with the declination, or, as it was then called, the variation of the compass. He discusses its observation and measurement, the influence of islands, the results obtained by travellers to distant parts, Nova Zembla, the Guinea coast, the Canary Isles, Florida, Virginia, Cape Race, and Brazil. Then he recounts his experiments with terrellas having uneven surfaces to represent the irregularities of the earth's crust. He points out errors arising from the fallacious practice of setting the needle obliquely under the card. He considers in separate chapters the variations in Nova Zembla, in the Pacific, in the Mediterranean, and in the Eastern ocean. The fifth book is on the dip. Gilbert seized with avidity on Norman's discovery of this effect, and devised an improved form of dipping-needle. He experimented on the dip of compass-needles placed at different points over his terrella, and evolved a theory on the proportion which he conceived

to exist between the latitude and the dip. Arguing from all too imperfect data, he propounded the view that the dip was the same in any given latitude; and proposed that seamen should ascertain their latitudes by simply observing the dip. He was aware that local irregularities might occur, as they do in the declination; but was not deterred by this knowledge from propounding his theory with much circumstance and considerable geometrical skill. After the publication of his book he developed the theory still further, and gave it to Blundevile for publication. At Gilbert's suggestion Briggs of Gresham College calculated out a table of dip and latitude. It was, however, soon found that the facts deviated more or less widely from the theory. Further observations in other lands showed the method to be impracticable, and



CAPPED LODESTONE.

Gilbert's hope to give to the mariner a magnetic measure of latitude remained unfulfilled. Book V. closes with an eloquent passage in which Gilbert affirmed the neo-Platonic doctrine of the animate nature of the universe, and asserted that Thales was right when he held (as Aristotle relates in the De Anima) that the loadstone was animate, being part of and indeed the choice offspring of its animate mother the Earth. Book VI., as already mentioned, is devoted to Copernican ideas, and contains Gilbert's one contribution to the science of astronomy, in his remark that the fixed stars (previously regarded as fixed in the eighth of the cælestial spheres at one common distance from the central earth) were in reality set in the heavens at various distances from the Earth.

From this brief analysis it will be seen that Gilbert's claims to eminence rest not upon any particular discovery or invention, but upon his having built up a whole experimental magnetic philosophy on a truly scientific basis, in place of the vague and wild speculations which

had previously been accepted. By his magnificent generalization from the small-scale models to the globe itself, supported from point to point by experimental researches, he created the science of terrestrial magnetism. If from the imperfection of the data at his disposal he fell into sundry errors of detail, he yet founded the method of philosophizing by which those errors were in due time corrected. And if for nothing else than his masterly vindication of scientific methods, and his rescue of the subject of magnetism from the pedantry and charlatanry into which in the preceding ages it had lapsed, his memory must be held in high honour. To the names of the men who made great the age of Queen Elizabeth, who added lustre to the England over which she ruled, and made it famous in foreign discovery, in sea-craft, in literature, in poetry, and in drama, must be joined that of the man who equally added lustre in science, Doctor William Gilbert.

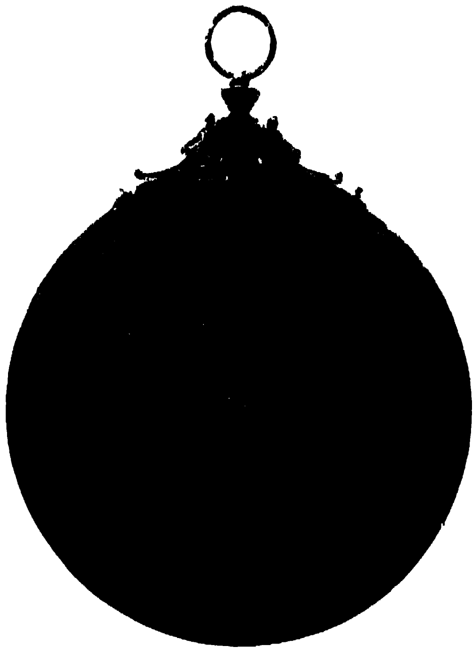
Alas! that of the personality of so great a man so little should be known. A brief but characteristic biography of him is enshrined by old Fuller in his 'Worthies.' The poet Dryden and the epigrammatist Owen celebrated him in still briefer verse. His portrait, which hung for nigh two hundred years in the Schools' Gallery at Oxford, disappeared a century ago, leaving only a poor engraving to perpetuate his scholarly countenance. Doubtless he is one of the four physicians depicted, by the pencil of Camden in his famous cartoon (now in the British Museum), as walking in the funeral procession of Queen Elizabeth. Of his handwriting not a vestige was known until about five years ago, when a signature was unearthed in the Record Office. Subsequently four signatures were found in the books of St. John's College; and recently there has come to light a volume of Aristotle bearing Gilbert's own marginal notes. His will lies at Somerset House; but it is only a copy. Of his fine collections of minerals and loadstones, which with his maps, books, manuscripts, and correspondence with Sarpi and Sagredo and others he bequeathed to the College of Physicians, nothing remains: they perished in the great fire of London.

In a quiet corner of the old city of Colchester stands the quaint old house where he lived, and where, according to local tradition, he once received the Queen. And hard by it is the Church of Holy Trinity, in which a mural tablet records his virtues and marks his last resting-place. But his true monument is the immortal treatise in which he laid the foundations of terrestrial magnetism and of the experimental science of electricity.

THE EXHIBITION.

A collection of books, maps, instruments, portraits and other objects, illustrating the progress of geographical science and enterprise during Queen Elizabeth's reign, was on view at the old University building on

the evening of the meeting, and remained open to inspection during the remainder of the week, being visited by large numbers, both of the



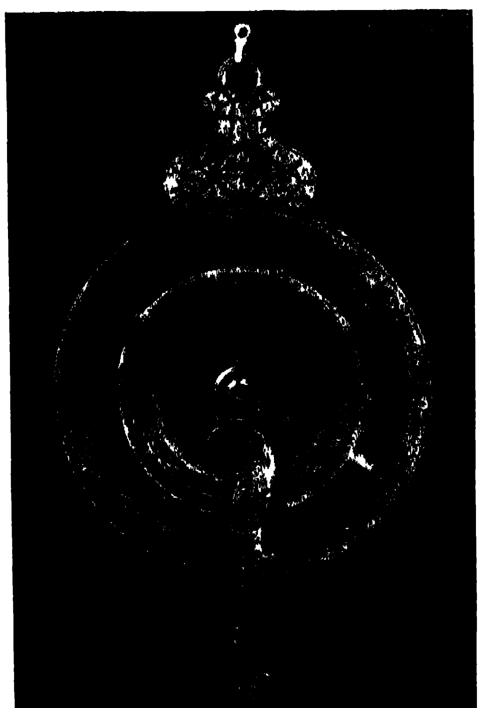
ASTROLABE. MADE IN THE YEAR 1571, WITH THE FOLLOWING INSCRIPTION: "GUALTERUS ANSCENIUS NEPOS GEMME FRISIJ LOUANIJ FECIT ANNO 1571."

Fellows and the general public. The collections of the Society were largely supplemented through the kindness of other public bodies and private owners, who showed great readiness to assist by the temporary loan of objects of interest, with the result that the exhibition was thoroughly representative of the geographical progress of the time in its various branches. The activity of the seamen and travellers of the Elizabethan age was illustrated both by the original narratives of the actors themselves, including, among others, Drake's 'World encompassed' (lent by Mr. S. W. Silver), and Hariot's and Smith's accounts of Virginia; and on the other hand by the famous collections of Eden, Hakluyt, and De Bry; while the 'First Court Book of the East India Company,' lent by the India Office, fittingly recalled the early days of British Eastern trade. The great advance made during the reign in the more scientific branches of geography, especially in the departments of navigation and nautical astronomy, was well illustrated by such works as Blagrave's 'Mathematical Jewell' (lent by the Cambridge University Library); the 'Mariner's Mirror' (lent by the Admiralty); Borne's 'Regiment of the Sea,' and Blundevile's 'Exercises.' In the field of cartography, the

most striking exhibit was the famous Mollineux globe of 1592, lent by the Honourable Society of the Middle Temple; while facsimiles of several famous maps, including that supposed to be alluded to by Shakespeare in 'Twelfth Night,' Hondius' map of the route of Drake and Cavendish, and Dudley's of Guiana, were also shown.

The contributions made by Elizabethan worthies to a topographical knowledge of our own country were well brought out by exhibits of fine copies of Saxton's and Speed's atlases, and of Camden's 'Britannia,' lent by Mr. Henry Yates Thompson; by the original (lent by the Guildhall Library) of Ralph Agas' 'Civitas Londinum,' showing London and adjacent parts in the reign of Queen Elizabeth; and by reproductions of other famous views and plans.

The collection of instruments was especially interesting as showing



A "NOCTURNAL." MADE A.D 1572. AN INSTRUMENT FOR TAKING THE ALTITUDE OR DEPRESSION OF STARS ABOVE OR BELOW THE POLE, IN ORDER TO FIND THE HOUR OF THE NIGHT.

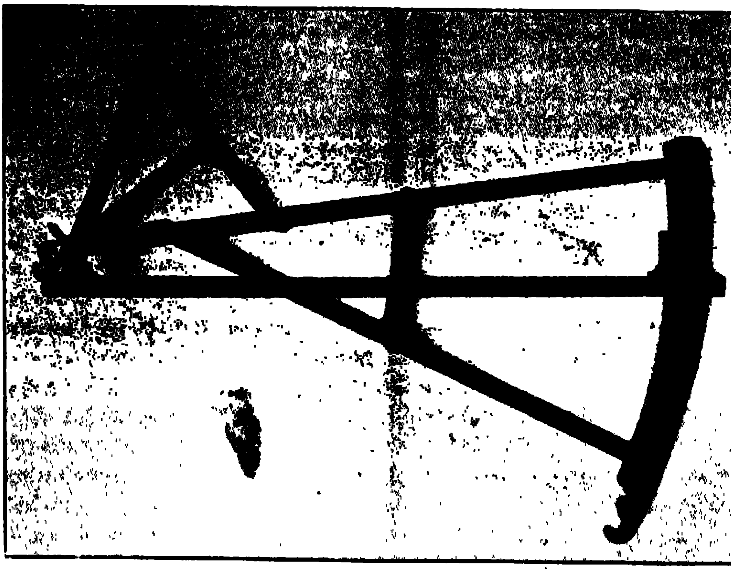
the comparatively feeble means by which the old seamen guided themselves in their perilous navigations, attaining results which are really

surprising when we think of the insufficiency of their outfit judged by modern standards. Several examples of astrolabes were shown, including that made for Sir Francis Drake before his first expedition to the West Indies, and now in the Museum of the Royal Naval College at Greenwich; and another found in the island of Valencia, Ireland, in 1845, and supposed to have belonged to one of the ships of the Spanish Armada, wrecked near the spot. Examples of 'Davis' Quadrant,' though of a later date than the Elizabethan period, gave a good idea of its prototype, the back-staff invented by Davis as an improvement on the cross-staffs previously in use for taking altitudes. Lastly, an interesting collection of dials, etc., lent by Mr. Max Rosenheim, included a finely chased set of mathematical instruments made for Queen Elizabeth by Barthelemewe Newsum, clock-maker to the Queen.

The exhibit of portraits consisted chiefly of photographic reproductions, by Mr. John Thomson, of old paintings and engravings They included two of the Queen herself, from the original portrait in the possession of the Duke of Bedford, and copies of early representations of most of the great navigators and patrons of discovery of the age.

OUGHTRED'S HOROLOGICAL RING, INVENTED IN 1650 MADE BY NAT. WILHAM.

Among the medals and seals, those which attracted most attention were the Armada medal, struck by the Queen to commemorate the destruction



DAVIS'S QUADRANT, OR BACK STAFF, FOR OBSERVING ALTITUDES.

of the Spanish fleet (lent by Dr. Henry Woodward), and the original seals of office of Sir Walter Raleigh as Governor of Virginia, etc. (lent by Messrs. Crichton Bros., of Old Bond Street). The ships of the time were well exemplified in a picture, lent by the Society of Antiquaries, showing the embarkation of Henry VIII. at Dover in 1520, when about to meet Francis I. of France; while another interesting memento of the period was a photograph of the chest formerly kept at Chatham to hold the funds for disabled seamen started by Hawkins and Drake.

Lastly, a brief reference must be made to the interesting collection of books and other objects mainly illustrative of the work of Gilbert, exhibited by Prof. Silvanus P. Thompson. It included all the three early editions of the De Magnete, with the modern reprints and translations, as well as various other early works on magnetism and navigation, and portraits and autographs of Queen Elizabeth, Drake, and Gilbert.

The PRESIDENT: Before we adjourn to inspect the exhibition, I think you will all wish to pass a vote of thanks to the very accomplished Elizabethans who have addressed you this evening, and who have thrown so much light on the character of Sir Walter Raleigh, on the important discoveries of Sir Francis Drake, and on the valuable work of Dr. Gilbert. I may mention that the exhibition will be kept open until the 28th inst., that is, during the whole of the present week, and that it will remain in the rooms here and will not be removed to the Map Room of the Geographical Society, which is not large enough to contain it.

CHARNWOOD FOREST: A BURIED TRIASSIC LANDSCAPE.*

By W. W. WATTS, M.A., M.Sc., F.R.G.S., Sec. G.S., Assistant-Professor of Geology and Physiography at Birmingham University.

INTRODUCTION.

CHARNWOOD FOREST is situated in Leicestershire, about 6 miles north-west of Leicester, and 3 miles south-west of Loughborough. It is practically defined by a curved line joining the following villages and hamlets: Woodhouse Eaves, Cropston, Groby, Markfield, Bardon, Whitwick, Thringstone, Sheepshed, and Nanpantan. Although once famous for its slates, its chief industry now consists in road-metal, paving setts, and artificial flagstones. Some of the land is agricultural, but most of it is devoted to parks and private residences, partly because of its picturesque relief, but partly, also, because the soil is often barren, supporting only moorland and forest growth, and so can be better given over to hunting and shooting. The land is also utilized for the purposes of water-supply, and as a lung for the towns of Loughborough and Leicester, and, since the opening of the Great Central Railway, by Nottingham and other towns.

CHARACTER OF THE LANDSCAPE.

The most obvious feature of its landscape is the sharpness of the contrasts that it presents. While much of the lower ground is flat and monotonous, with a good soil, fertile and occupied by farms and gardens, the hills are sharp and stony, with a poor soil and a scanty vegetation; they frequently culminate in a crag or ridge with abrupt sides and a narrow crest; indeed, the walls of the crags, although of no great height, are sometimes vertical, and occasionally even overhanging. Fig. 1 shows a hill with several crags, separated by a pastoral flat from a second craggy hill, from which the view was taken Again, while most of the valleys have soft and rounded contours, with alluvial flats and marshes, there are a few which are winding and gorge-like, with flanks of steep and bare rock, and with the streams running over rocky beds. Other characteristic features of the landscape will be pointed out later on.

THE TWO ROCK TYPES.

The sharp contrasts above alluded to at once suggest to the geologist abrupt contacts of two very different classes of rock, and the examination of the numerous sections soon proves that this surmise is correct. The bolder scenery is found to be based on hardened and ancient Charnian rocks of pre-Cambrian age, principally volcanic in origin; the milder landscape is based on the Keuper Marl of the Triassic

* Read at the Royal Geographical Society, March 9, 1903. Map, p. 700.

System, which has long been known to rest unconformably on the older rocks. The woods, crags, and higher grounds in Fig. 2 are situated on Charnian rocks, the lower ground on the Keuper Marl.

The ancient rocks are of several types, but the dominant one is a bedded series of fine and coarser volcanic tuffs interbanded with coarse agglomerates and breccias, and passing up into conglomerates and slates (see Figs. 4, 5, and 7). These rocks are folded into an elliptical dome the long axis of which points north-west and south-east, but only the southern half of this structure is anywhere exposed. The rocks are cut by faults, jointed, and cleaved, and there have been intruded into them three or four different kinds of igneous rocks, including "porphyroids," syenites, and granites. Sometimes these are in small dykes or bosses, but at Peldar and High Sharpley (see Fig. 8), at Bradgate Park, Groby, and Markfield, and at Mount Sorrel (see Fig. 12), the masses are of considerable size, their outcrops measuring from half a square mile to nearly a square mile in area. It is these igneous rocks which are chiefly quarried for road-metal.

All the rocks are much hardened by pressure, silicification, or the formation of epidote, and as a consequence there is comparatively little differential weathering or denudation along stronger or weaker kinds. On the whole the rocks of the lowest and highest divisions are relatively weaker, while the middle division is the one which tends to stand out in a broken horseshoe of hills.

The newer or Triassic rocks belong to the upper or Keuper division of that formation. Only in the north is the Keuper Sandstone visible; if it occurs further south, it is so far underground that it has never yet been seen. The dominant covering rock in the rest of the area is the Keuper Marl or New Red Marl—a soft red clay of considerable thickness (see Fig. 3). Its basement beds, when they are seen to rest on the ancient rocks, contain a small thickness of breccia, the angular blocks having been derived from the Charnian rocks beneath; but this is rarely of any thickness. A few bands of greenish sandstone, locally called "skerry," occur here and there, generally made up of material broken from the Charnian rocks. Fig. 3, taken at Croft Hill, south-west of Charnwood Forest, shows the relation of the Keuper Marl, with its green bands, to the Charnian rocks beneath, and it also shows the basal breccias made of angular fragments denuded from the underlying series.

Unconformable Relations of the Rocks.

Thus a county in which the landscape reminds one of patches of Wales planted amongst the level pastoral country of the Midlands is proved by geological examination to be really a landscape of Welsh type *submerged under* the New Red Marl, the dominant rock of the English Midlands. Further examination shows that the cover is in many places a thick one, and that the ancient rocks are for the most

FIG 1 The Hanging Rocks, Beaumanor Park, Woodhouse Eaves looking S E

FIG 2 Bradgate Park, Crags of Charnian Rock rising from flat Triassic ground

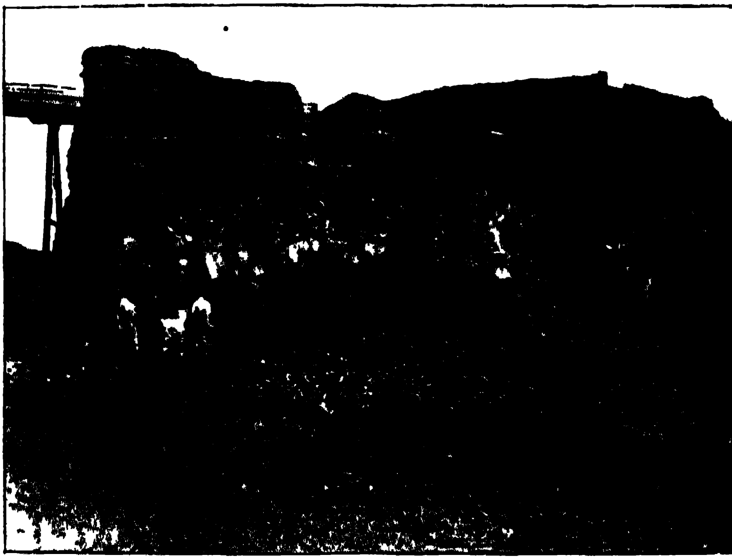


FIG. 3. Croft Quarries. Keuper Marls and Breccias resting unconformably on Syenite.

Taken by permission from a photograph by Messrs. J. Burton & Sons, of Leicester.

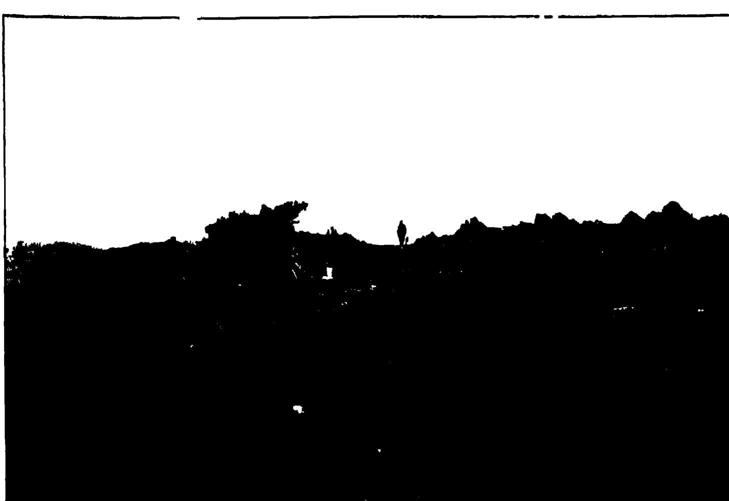


FIG. 4. The Hanging Rocks, Beaumanor Park, looking N.W.

From a photograph by Mr. F. R. Rowley, of the Town Museum, Exeter.

part so deeply buried that only their highest points protrude through it. It has already been pointed out that the protruding parts are steep and mountain-like (see Fig. 4). Observations in the visible sections prove that these steep slopes are continued under the *cover*, and this is in accord with the experience of the quarry-owners in their attempts to obtain rock beyond the limits of the actual outcrop. It is speedily found that the amount of waste cover (New Red Marl) to be removed renders it too expensive to attempt to win the rock far from its visible outcrop. Records of well-sections collected by Mr. Fox-Strangways give further proof, for wells have been sunk a few yards away from the visible outcrop of the ancient rock without reaching that rock at a depth of many feet.

Thus the New Red Marl is actually covering a mountain system of which the summits alone are visible, while the flanks and intervening valleys are for the most part buried and filled up with the newer formation. Areas like the granite knobs of Mount Sorrel, the copse-clad crags of Bradgate Park (see Fig. 2), or the isolated rocks in the centre of the Forest about the headwaters of the Blackbrook, give examples of innumerable summits, from a tenth of a square mile to a hundred square yards and less in area, standing forth like islands from a sea of Marl. The more important ridge of Bardon Hill, the highest summit in the Forest, is closely cloaked with the Red Marl, which rises over 800 feet on its flanks. And the three much greater masses, the first extending from Peldar Tor to Grace Dieu, the second including the Outwoods, Beacon Hill, and Broombriggs, and the third the central massif round Benscliffe, while flanked with Marl to varying heights, push out many summits, shoulders, and buttresses, as well as the flanks which intervene, through the cloak.

Amongst the best localities for studying the actual unconformable relations of the cover to the ancient floor may be mentioned the following: Bardon Hill, Newhurst Quarry, Groby, Sheet Hedges, the quarries about the Brand and Swithland (see Fig. 6), and the district of Woodhouse Eaves (see Fig. 5).

Of the summits pushing out from what the map shows to be a plain of Trias around them, Shortcliffe, Longcliffe Plantation, Collier Hill, Cat Hill, Spring Hill, and those about Buck Hill, are perhaps the most striking for the actual steepness of their slopes, the boldness of their outline, and their unexpectedness when met with in the middle of the woods which have been preserved or planted round the majority of them. They are veritable peaks and arêtes, with one and sometimes two very steep sides, and often with an abrupt end. The isolated crags of Beacon Hill and Broombriggs (see Figs. 1 and 4), and those of the Hanging Rocks grounds in Beaumanor Park (see Figs. 1 and 4), those of Warren Hill and about Whitwick, are more easily seen and less closely mantled in Trias, so that they rest on their own moorland bases, which again in turn rise out of the Trias of the lower grounds.

Topography under the Trias.

At the southern slate quarry at the Hanging Rocks (Woodhouse Eaves) the abrupt drop of the ancient rock down to and under the Trias is well seen, and there is exposed in the quarry a small valley cut in the Charnian rock, and so filled up with Trias that there is no trace of it to be seen in the contour of the ground above (see Fig. 5).* Here there is also a small quantity of breccia at the junction of the two rocks.

A small abandoned and water-filled slate quarry just south of bench-mark 324, on the road from Swithland to Roecliffe Hall, shows a section of a similar valley at each end of the quarry, filled with New Red Marl. The steepness, depth, and direction of that valley are here clearly shown (Fig. 6). Traces of other buried valleys occur in the grounds of the Brand and elsewhere about Swithland, while there are others on Bardon Hill, and doubtless many more could be found in section if looked for.

Thus the study of sections actually reveals something of the character of the ancient topography underneath the Trias mantle, and shows that it is in no way different from that part which to-day protrudes above it.

It is quite evident that denudation, acting on two rocks of such wholly different hardness as the strong Charnian hornstones, slates, and igneous rocks, and the weak Trias Marl, will, so to speak, melt the latter rapidly away and leave the former comparatively untouched, at any rate for a considerable time. Now, many of the knobs of ancient rock are very tiny, only a few square yards in area, and they can only have been exposed for a very short time; indeed, some were actually entirely covered with Trias until exposed by quarrying. The latter must, of course, still have the shapes given them before they were buried up, while there can be no question that the same is almost wholly true of the tiny patches exposed during the last few centuries of ablation. Now, although the breccia at the base of the Marl bears witness to the denudation of the rocks in Triassic times, these small patches show hardly any signs of recent denudation, except just a little frost action, and little, if any, of their *débris* extends on the surface of the ground beyond their contact with the Marl. The rocks are insoluble, intensely hard, and throw off the water quickly from their steep slopes on to the surrounding Trias; hence they suffer little, and the denudation is therefore concentrated on the Marl, particularly along its contact with the older rock. Thus the patches gradually grow in area and height by the ablation of the surrounding Marl.

To a great extent, this is also true of such of the larger patches as have been wholly buried. The actual amount of denudation they have suffered since the Trias was removed from them is very small indeed.

* Bonney, 'The Story of our Planet,' p. 418.

FIG. 5. Slate Quarry, The Hanging Rocks, Woodhouse Eaves Valley in Slates filled with Keuper Marl.

FIG. 6. Slate Quarry near the Brand, near Swithland. Charnian slates can be seen to the left and rising above the water to the right. The vegetation between covers the Trias Marl, filling an old valley.

They show no signs of glaciation, and their peaked and jagged character, though doubtless slightly accentuated since they were uncovered, would seem to be that which they possessed when originally covered up by the New Red Marl (see Fig. 7).

A Triassic Landscape.

If this is a correct interpretation of the evidence yielded by the character of the unconformity where seen in quarries and mapped upon the ground, the landscape presented by those parts of Charnwood Forest which are made of the ancient rocks had its present character in Triassic times. It is, indeed, a *Triassic landscape* which is now being uncovered again or "developed" for our inspection, and we are at liberty to use it to picture to our minds the appearance of this part of England in Triassic times (see Fig. 8). And we are further at liberty to follow the idea out to its logical conclusions.

History of the Landscape.

The Trias was a period of desert, salt lake, and intra-continental conditions, and we may think of Charnwood as being, at that date, like the mountains in the neighbourhood of the Great Salt Lake desert, which now lie partly buried up under the sediments of the ancient Lake Bonneville.* The presence of the Keuper Sandstone over part of the Charnwood area and its absence in other parts seem to show that, though almost, if not quite, buried under the Keuper Marl, many of its mountains and ridges stood out of the desert in which the preceding Keuper Sandstone was laid down.

Lower Trias and Permian rocks are absent from the area; but the neighbouring Permian Breccias of Leicestershire have been shown by Mr. Horace Brown † to contain fragments such as might have been weathered off the Charnwood mountains in Permian times.

The Coal-measures flank the west of the Forest, and rest directly and unconformably on the Charnian rocks; and the small patches of the earlier Carboniferous Limestone at Breedon and Grace Dieu, with their dolomitic character, seem to prove that, though the higher peaks emerged at this date, the lower flanks of the range were encroached upon by the sea. Indeed, the Charnwood mountains would appear to be the north-easterly extension of the well-known land-barrier or barriers which extended across the Midlands from Wales in early Carboniferous times, and were not even completely submerged in late Carboniferous times.

As the bases of the mountains, at any rate, were being submerged in Carboniferous times, the date of their actual structure and emergence

* Gilbert, *Second Annual Rep. Amer. Geol. Survey*, p 169.

† *Quart. Jour. Geol. Soc.*, xlv., 1889. p. 1.

as mountains must go back to earlier times. How far back we cannot say, but the next earlier period, that of the Old Red Sandstone Period, was a time when much of Britain was lofty land interspersed with broad lakes. As no Old Red Sandstone or Silurian rock is known nearer than South Staffordshire, and no visible Cambrian nearer than Nuneaton, it is not possible to deal with the Charnwood area at these periods.

This, however, we do know. The ancient rocks are of pre-Cambrian date. The first earth-movements to which they were subjected are amongst the earliest of which we have any knowledge in Britain; they have movement-structures which make the Cambrian rocks of Nuneaton look young beside them. We cannot possibly suppose that they were elevated into a mountain range later than the post-Cambrian period, and they may very well have had their structures impressed upon them much earlier than that. It is by virtue of these structures that they constitute a mountain range. We may therefore, without prejudicing our right to go back, should newer discoveries warrant it, to still earlier dates, confidently state that at whatever period the mountains were actually formed, they must have stood high above the land as a great range in Old Red Sandstone times, and that they could have received much of the earth-sculpture which shaped their details at that period.

Explanation of Characteristic Features.

Amongst the characteristics of the sculpture there are two noteworthy features. In the first place, there are no escarpments and very little differential denudation; indeed, nearly all the exposed ridges are *plagioclinal*, and at Collier Hill, Beacon Hill, Broombriggs and elsewhere not only are the rocks seen to strike obliquely across the ridges as a whole, but even the smaller crags are plagioclinal too (see Fig. 9). One or two features—Ives Head, for example—look so much like escarpments that they might be photographed as such, but an examination on the spot shows that they have no escarpment structure. This seems to indicate that at the period of sculpture the rocks had been so hardened that they were all about equally strong and they all resisted equally. They were also cleaved and jointed, and the planes of these structures, together with the marked bedding surfaces, gave the guiding directions to denuding forces. Such sculpture might very well have been effected under Old Red Sandstone conditions, when the mass was cut up by rapid streams into fiord-like valleys separated by ever-sharpening ridges and arêtes.

In the second place, ridges are often cut off without any apparent reason, rather after the manner of the sea with capes and headlands than of transverse streams (see Figs. 1 and 4); hence it is possible that, after subaërial sculpture in Old Red Sandstone times, there may

Fig. 7. Broombriggs near Woodhouse Eaves. Crags of indurated volcanic tuffs.

Fig. 8. Summit of High Sharpley. Cleaved porphyroid.

Fig. 9. Summit of Broombriggs. A plagioclinal ridge.

have been marine erosion of the ridges into islands in the Carboniferous sea, evidence for the encroachment of which has already been given.

Next came the probable re-elevation of Permian times and the weathering which contributed to the distant Permian Breccias, and then the desert and "Lake Bonneville," conditions of the Trias, the deposits at first only reaching the lower roots of the range, but gradually encroaching higher and higher as the lake deepened or the desert sands thickened in the fashion described by Captain McMahon in Baluchistan.* Further reference to this phase is reserved for the conclusion of this paper.

The general character of landscape blocked out in Old Red Sandstone times and modified in the Carboniferous Period was retained and accentuated by the Triassic weathering while the lower flanks were being covered; and finally, at the end of the Triassic Period, the rapid deposit of the Marl, whether from water or air cannot yet be satisfactorily determined, buried up many, if not all, the summits of the area, and laid them up with all their latest characters in lavender, as it were, to be gently unwrapped and reverently studied in modern times.

Whether or no the Triassic covering was complete up to the highest summits, the writer has not been able to determine from observations yet made. The fact that no streams cross the Forest, but that all of them rise within it, and mostly about the central and highest parts, is in favour of the view that certain of the knobs are "monadnocks," which have always remained undestroyed and uncovered. It might be argued that a similar result would be likely to follow from the general ablation of the country. Certain characters of the modern streams are, however, against this view, as will be seen later.

The area may be regarded as closed, and covered up completely during the Jurassic and Cretaceous times. Of its condition in Tertiary times we have no evidence. Whether originally covered completely or not, it is quite certain that some parts of the ancient rocks were open in the Glacial Epoch, for blocks of Mount Sorrel granite and other Charnwood rocks occur as boulders in the neighbouring districts, and boulder-clays nestle against the granite itself in many parts of the Mount Sorrel area. But while this is undoubtedly true of the outer and higher summits, the writer inclines to the belief that much of the ablation which laid bare the summits of second and third importance did not reach them till after the Glacial period.

Redevelopment and Superposed Drainage.

The general character of the geological map of the country, and particularly the old edition of the Survey geological map, which allowed a larger area to the ancient rocks and a smaller one to the

* *Quart. Jour Geol. Soc.*, liii, 1897, p 289

Trias than has been proved by Mr. Fox-Strangways to be actually the case, shows that the Trias fills fiords which run in the direction of the structure of the country, generally in a north-west and south-east direction. The following may be mentioned as important and obvious: the Upper Blackbrook fiord, the Shortcliffe fiord, the Alderman's Haw fiord, the Ling Dale fiord, and the Ulverscroft fiord. The scenery of these fiords is very striking, particularly as they are traversed by some of the more important longitudinal roads of the district. They are also generally occupied by streams during part of their course. This, of course, is only natural. For the reasons already given, after ablation had exposed any of the ancient rock, water would tend to flow along the junction of the ancient rock and the Trias, and to erode its course along that junction. Little by little the Trias area would be lowered, and the tendency would be to gradually empty the Marl out of the old fiords, and to dissect out the fossil landscape. In the centre of the district, where the old summits stood high and the Trias mantle was thin, this would obviously occur, but the streams would then pass outward to the flanks, where, however, the Trias was increasingly thicker. Here there would be nothing to guide the streams. If they began to wander at all and incised their courses deeply in the Marl, there would necessarily be many places where they would depart from the ancient topography, and they might come upon buried masses or ridges of ancient rock, which they would be then compelled to deal with. In the former case the mass would be skirted and "developed" by the stream, as Shortcliffe has been picked out in the course of the Shortcliffe brook, or the Rock Villa crags developed by the Upper Blackbrook. In the latter case the ridge must be cut through, and a gorge would necessarily be carved out by the stream which had "lost its way." There is hardly a stream in the Forest which does not do this, and the consequence is that, while it is cutting its transverse gorge, the slack stream behind it, having reached a temporary base-level, has never been able to empty the old fiord of its contents of Trias Marl. The following examples of transverse gorges, cut as escapes at the side of partly emptied fiords, will be noticed on consulting the map: the Ingleberry gorge on the Shortcliffe Brook; the Whittle Hill and Forest Gate gorge on the Wood Brook (Alderman's Haw fiord); the Brand gorge at the foot of the Ling Dale fiord (see Fig. 10); the very striking Bradgate Park gorge at the foot of the Ulverscroft fiord; and the Grace Dieu gorge, cut by a brook which rises in the hollow north of Bardon Hill, escapes from the Forest for a time, skirts it through Whitwick and Thringstone, and then doubles back through Grace Dieu Woods in a picturesque little valley.

The marked exception is the Middle Blackbrook, the course of which, being mainly north-westward and northward, has not so far encountered any ridge of buried Charnian rocks. In consequence of this, it maintains throughout a considerable fall, and has scooped the Trias right

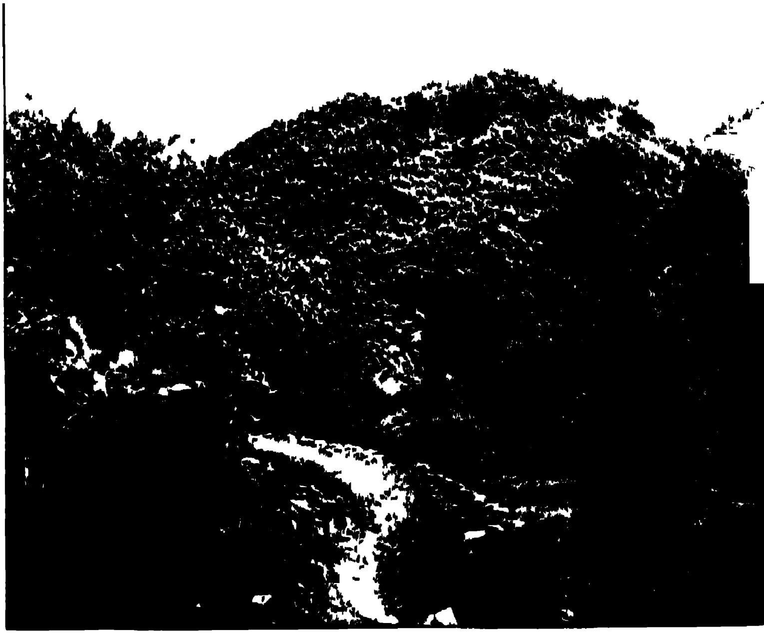


Fig. 10 Cuckoo Hill, the Brand, near Swithland A transverse gorge cut by a stream escaping from the side of a partly emptied Triassic fiord

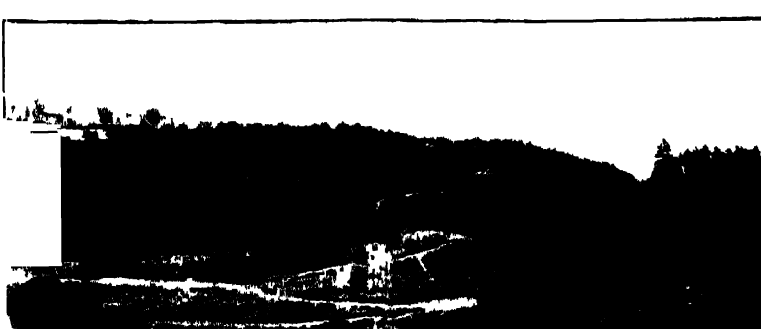


Fig. 11 Blackbrook An emptied Triassic fiord.

out of the fiord in the middle part of its course, and exposed to our view a valley unique in the Forest—steep sided, winding, rock bound, and extremely beautiful (see Fig. 11). Although the modern stream must have unquestionably deepened and somewhat altered the outline of the old rocks in this valley when it did meet with them, there can be little doubt that the main outlines and character date, like the rest of the landscape, to pre-Triassic times. And it is interesting to observe that the Blackbrook valley, in its outline and character, recalls rather strikingly the deep-cut "gutters" and "batches" as they are called, in the Shropshire Longmynd, where the rocks are of similar character and presumably of about the same age as those of Charnwood.

Relief in Triassic Times.

The interest aroused by these topographic questions in the writer's mind suggested the possibility of constructing a map of the outline of Charnwood Forest as it existed in Trias times. The outlines of the Trias were therefore inserted on the contoured 1-inch map of the Forest, and new contours were drawn to express the heights at which the Trias had been mapped in contact with the ancient rocks. Unfortunately, the information failed where it was most needed—where the Trias became thick and the ancient rocks were deepest underground; but some important points came out clearly. The ancient rocks were found to show at the surface at three classes of places; (1) the hilltops, where the general ablation had melted away the Trias so as to expose the highest points of the old Charnian range; (2) where the superposed streams, following the old fiords, had cut down sufficiently deeply to "develop" the ancient Triassic topography; and (3) where the superposed drainage had "lost its way," and, after traversing an old fiord for some distance, had turned aside and cut across ridges formerly buried under the Trias

This map, confessedly an imperfect first effort, is given as an attempt to delineate roughly the general outline of the country in Triassic times. It shows, as might be expected, that the Triassic topography is for the most part on the same lines as the existing topography, but more pronounced; the hills steeper, the valleys deeper, and the general plan, on the whole, rather simpler. But it also shows that, so far as they can be followed, the outlets of the old fiords depart very considerably in many cases from their present outlets; and it also indicates that as erosion proceeds, not only most, but all, of the streams will probably realize that in attempting the dissection of the old topography, they have often, like an inexperienced surgeon, chosen to cut in directions which will give them a great deal of trouble because they are not consistent with the underlying anatomy.

It may be pointed out here that this want of exact adjustment in the superposed streams may be used as an argument that the very highest summits of Charnwood have always remained above the Trias,

or else the adjustment of the heads of the stream-system to the highest Charnian summits would not be likely to have occurred.

WIND EROSION.

It may well be expected that a landscape which dates back to Triassic times, and which ought to have received the finishing touches of its sculpture at that date, should bear some hall-mark. It has been the good fortune of the writer to find this, but as the discovery has been notified elsewhere,* and will be more fully described at a later date, a short reference to it must for the present suffice.

It has been long known that the granite of Mount Sorrel, when "unbared" for quarrying, frequently shows a rounded, smoothed, and terraced surface. As this surface was first discovered and photographed in contact with Boulder-clay, it was not unnaturally attributed to glaciation. Quite recent excavation at Mount Sorrel (see Fig. 12), Hawcliffe and Nunckley Hill have, however, exhibited the surface in contact with New Red Marl, the basement layers of which were made of fragments of disintegrated but undecomposed granite. Knobs, projecting upwards in a way which would be impossible under ice, have been found by Mr. Teall; while the section at Nunckley Hill showed that the ice which deposited the Boulder-clay there had been unable to scrape away a thin skin of New Red Marl which remained between the terraced granite and the boulder clay.

The terracing and smoothing might perhaps be explained by wave-action, but the fact that the granite surface is perfectly fresh and undecomposed is in favour of the existence of a dry climate while the covering Marl was being deposited. Further, in the immediate neighbourhood of one of the most characteristic junctions of granite and marl there were found first one and then several examples of highly polished granite, not *in situ*, but obviously derived from about that spot with the peculiar irregular and glazed surface which is only known as the product of wind and sand erosion. These specimens have been shown to those familiar with desert-wind erosion, and they have unhesitatingly stated their belief that wind charged with sand must have been the agent operating on these specimens of granite.†

It seems, therefore, legitimate to conclude that the Mount Sorrel granite was exposed to the sand-blast of wind-erosion in the earlier Triassic times, and that it acquired its characteristic smoothness and polish, and perhaps its rounding and terracing, as the result of wind-erosion in the Triassic deserts, before it was finally buried and sealed up under the New Red Marl.

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* Report of British Association, 1889, p. 748: and *Proc. Geol. Assoc*, vol. xvii., 1902 p. 373.

† See also La Touche, *Mem. Geol. Survey of India*, vol. xxxv. pt. i. p. 9 and pl. i. and Bonney & Hill, *Quart. Jour. Geol Surv*. xxxiv., 1878, p. 230.

FIG. 12. Mount Sorrel, Charnwood Forest. Smoothed and terraced granite covered by Keuper Marl.

From a photograph by Mr. P. W. M. Wright; block lent by Dr. H. Meadows.

CONCLUSION.

The writer would like to point out that, although the conclusions brought out by this paper are essentially of a geographical character, the whole of the observations and the methods of drawing conclusions from them are the outcome of geological work and the geological method. This paper is an illustration of the mutual obligation of the two sciences to each other.

The relations of the Charnian and Triassic rocks in the forest have been known to geologists since the work of Sedgwick and Jukes. They were mapped on the old edition of the map of the Geological Survey, and referred to by Bonney and Hill in a series of papers to the Geological Society and elsewhere.

The outlines of the areas of ancient rock defined in the maps is the work of C. Fox-Strangways, Esq., F.G.S., executed for the revised map of the Geological Survey. The conclusions of the author are largely the outcome of observations made during the study of the Ancient Rocks of the Forest, also carried out for H.M. Geological Survey, though some of the observations, and a good many of the inductions, are the result of work executed since he ceased to be a member of the Survey staff. The geological information on the two maps which accompany the paper are presented here with the permission of J. J. H. Teall, Esq., the Director of the Geological Survey. Of the photographs reproduced, the majority are from negatives taken by the author, but No. 3 is the work of Messrs. J. Burton & Sons, of Leicester; 4, of Mr. J. R. Rowley, of the Exeter museum; 7, of Mr. W. Jerome Harrison; 8, of Mr. P. H. Levi; and 12, of Mr. P. W. M. Wright. The block from which the last is printed has been kindly lent by Dr. H. Meadows, of Leicester.

Before the reading of the paper, the PRESIDENT said: I think we shall all agree that there is as much that is interesting to geographers in our own island as there is in any other part of the world between England and the Antipodes, and therefore I believe that I can promise you an extremely interesting paper from Prof. Watts this evening. I now ask Prof. Watts to read his paper.

After the reading of the paper, the following discussion took place:—

PROF. BONNEY: Geologists are supposed to be about the most quarrelsome of people, so I suppose I have been called upon in order that I might fall foul of Prof. Watts's paper. But in regard to that there are two difficulties—one, that although my friend, Mr. Hill, and I were working at that region so long ago as the later sixties and the earlier seventies, when I suppose Prof. Watts had not yet left school, and that very fact brought him up to Cambridge and enabled us to enter into such very pleasant relations there as teacher and pupil, I always find myself with an unconquerable prejudice in favour of everything he does and says; and the other that I really have no objection to make. When we were at work in this region we directed our attention chiefly to the nature of the Charnwood rocks themselves, and only incidentally noticed their superficial features. But in my old note-books I have sketches of these very valleys which have been shown to you on the screen to-night, and I can remember in one place where, in an exceedingly pretty glen,

there were fragments of the old Keuper marl still sticking to the Charnwood rocks which Prof. Watts has described to you to-night. We dwelt lightly upon it then, because we were not at that time directly concerned with it. You have exactly the same thing in a district to the south and south-west, and I may quote one instance from that to show you how curiously concealed some of these buried hilltops are. There is a quarry worked between Narborough and Croft Hill, which was concealed until a very few years ago, and certainly, from all I could ascertain, in some parts could not have been more than 3 or 4 feet underground. But judge of my astonishment at my last visit to find that they had opened new quarries where I remembered ploughed fields, and where there had not been a trace of rock visible in those parts. It seems to me that there is no question that Charnwood is a piece of fossil geography which has been preserved to us like one of the mummies in an Egyptian tomb, from which Nature has quite recently taken off the protective cover under which it was buried long ago. With regard to this protective cover, whatever may be the most novel idea, I confess I do not know what ground there can be for that alternative view which Prof. Watts put forward. I do not understand how to get from wind-action so extensive a deposit, or one with salt and gypsum; but let that pass. I have noticed some of those features to which Prof. Watts called your attention in the later part of his lecture, but I never saw any case of that peculiar surface on granite in contact with the Keuper marl itself. Those I saw were always in contact with the glacial drift. A very common type of them is something like a ploughed field, with the top of the ridges worn away, and I thought this probably had been produced by slabs of ice grinding upon the shore, and I used it to show that there was no true glacier-worn rock in that district. Those sections were not uncovered when we were there; and with regard to that photograph of the fluted rock, unquestionably that is due to the action of sand driven by the wind, for it is curiously like a specimen which I collected years ago in the neighbourhood of Burntisland. There a little lump of basalt, 3 or 4 feet high, stuck out from the sand, and it was fluted in the same curious spoon-like grooves, the grains of sand impinging on it and scooping out by degrees one of these long hollows; so I have no doubt Prof. Watts is right in saying that the desert-born sand, before the great Salt lake formed, produced these singular surfaces on some of the hills of Charnwood Forest. We have here, then, a piece of fossil geography that goes back to a time so remote that mammals then were only just beginning to make their appearance upon the face of the Earth.

Mr. H. J. Mackinder: In common, I imagine, with every one in this room, I listened with the greatest admiration to Prof. Watts's lecture. There was one point at the end of it upon which it may perhaps be desirable to say a word or two. Prof. Watts pointed out that this lecture of his illustrates the exceedingly close connection between geography and geology. In fact, I have heard one or two criticisms to the effect that this was a geological and not a geographical paper. The position, I think, is certainly what he claims, that in the most beautiful manner this study illustrates the close connection between geography and geology, and also the distinction between them. Some years ago I ventured to suggest as a formula for the expression of that distinction, that the geographer looks at the past in order that he may understand the present, and the geologist at the present in order that he may understand the past. You will notice that Prof. Watts borrowed from the geographer for the purpose of proving that sand had smoothed the surface of certain rocks; he took expert opinion from those who had seen the action in process in the deserts. Prof. Watts comes back to us to-night and repays with interest the loan which he had thus taken from the geographer, by presenting to us a vivid conception of the present surface of the land, and explaining the fact

that that surface is in the main the rock mantle of an old landscape whose peaks alone now penetrate to the air. Such a conception is valuable both to geologists and to geographers, but from it they start in two different directions: Prof. Watts goes back to the old Triassic conditions to realize what was then the physical geography of the land, whereas the geographer will tend to be drawn forward and to picture to himself the wide expanse of the Triassic marls of Leicestershire and Warwickshire overgrown until recently with the great forest of which Shakespeare's Arden was part, and will then realize how the Romans constructed their neighbouring Watling Street, bringing from these unsheathed summits of an ancient landscape the material wherewith to make roads over the fertile marl surface of the country around. It is no unimportant fact that the marls of central England were laid down upon this worn rocky surface, for in Russia and in Hungary you have large expanses of soft rock which waited until these railway days to be developed agriculturally, because there was no hard rock rising through a softer mantle to furnish materials wherewith to construct ordinary roads. It is for this, among other things, that some of us have been struggling in the reform of geographical education. We ask those who have to base economic and political geography upon physical geography not to be content with the surface, but to take over from geology such an account of the structure as an artist must obtain if he wishes to understand sympathetically the outer curves of the human body. We and the geologists are in part studying the same material. The tendency of the geologist is like that of the historian, to study the past; the tendency of the geographer is precisely like that of the political philosopher—he looks at the current forces shaping the destinies of the world, but requires history to explain the facts. Such distinctions are not very important to the researcher. As Prof. Watts has said, he has obtained some geography as a by-product of his geological research. The researcher is careless of the boundaries, which must, however, be jealously considered by the organizer of academic studies. I venture to say, sir, that Prof. Watts's paper has most admirably illustrated both the closely cognate character of geography and geology, and in the most repeated manner the contrast in their points of view.

Dr. Blanford: I rise in accordance with your request, but I do not know that I have very much to add to what has already been said. I am afraid that to those who have been accustomed to geography in its narrow sense, it may appear that this paper is rather different from what we usually have. I think that when we turn to these formations of which we have had a very curious instance given us to-day, we shall find much worthy of study, and, so far as we have gone, I may say that the uniformitarian theory seems to be wonderfully supported. All the details of this very remarkable landscape in the centre of England agree marvellously with those which we find in different parts of the world at the present day, and it is a matter of great interest and of great importance that we should be able to obtain so good a record of ancient landscape as in this case, because, as every geologist knows, the old surfaces underlying modern deposits are generally so much decomposed, that it is impossible to restore their contours with any degree of accuracy. And there is another interesting point connected with the facts Prof. Watts has so well put before us. Certainly the land itself has changed, but where was the Atlantic ocean? It is difficult to conceive of a country in this latitude with the Atlantic ocean in existence, and also with the intensely dry atmosphere that must have existed in order that the very peculiar form of desert landscape could have been developed, and this, I need scarcely remind you, is entirely in accordance with the views that are held by some of the foremost geologists of the present day.

Mr. G. G. Chisholm: I am afraid at this hour it would be very injudicious of me

to intrude with any lengthy remarks upon the paper we have heard, and any such remarks would be very unwelcome. But I will at least take the opportunity of expressing the pleasure that I have felt at being present at the reading of the paper, which, as Mr. Mackinder has described, belongs to the borderland of geography and geology. As the writer of the paper himself states, the methods of investigation in this paper are wholly and distinctly geological, but the results, nevertheless, are of peculiar interest to the geographer.

The PRESIDENT: The meeting, I am sure, will wish to thank Prof. Watts for the very interesting and to us very original paper that we have listened to with such pleasure to-night. Mr. Mackinder has admirably stated the occasions when geographers must study geology in order that they may understand the physical aspects of a particular region, and this has been well shown us by the paper that we have listened to this evening. I have now to propose to you a vote of thanks to Prof. Watts for his paper, and I am sure you will pass it with acclamation. Mr. Mackinder also pointed out to us the occasions when geographers must turn to history for help. I mention this because at our next meeting on March 23 I propose that we should not forget the occasion of the death of Queen Elizabeth, for during her long and admirable reign there were the beginnings of every department of our science. It was then first that explorers, both by land and sea, traversed almost every part of this Earth; it was then first that we began to understand cartography and to engrave maps; it was then first we began to have instrument-makers, and to improve upon the older instruments used; and, to a great extent, it was then that we first published atlases. Then first we published a great collection of voyages and travels. It was then first that we began our magnetic observations; indeed, it was that period in which were the beginnings of every branch of geographical science, and I therefore thought we ought not to pass that time without some notice, because it is good to look back and to remember those from whom we have inherited all we now know. I propose that, in addition to reminding ourselves of the work of our predecessors of that time, we also have a small exhibition of their instruments, their maps, and their books, in order that we may impress upon our minds the great work that was done during that long and memorable reign.

THE CARTOGRAPHY OF SPITSBERGEN.*

By Sir MARTIN CONWAY.

In the following article I do not propose to enumerate or discuss all the maps of Spitsbergen that may have been published between the time of its discovery and the commencement of the scientific exploration of the archipelago, but only those which I have been able to come across in a careful but not exhaustive investigation. There must have existed a great number of maps which I have been unable to trace, especially English maps, some of them of high importance. Many are probably lost beyond recall, the most important gap, as we shall see, being the

* Map, p. 700. For other reproductions of old maps of Spitsbergen, see vols. xv., pp. 129 (Barentsz's map, 1598); 129 (Hondius' map, 1611); xvii., 629 (Daniel's map 1613); 625 (Joris Carolis' map, 1614); xiv., 157 (Purchas' map, 1625); xvii., 631 (Joris Carolis' map, 1634).

records of the later explorations made on behalf of the Muscovy Company.

The earliest map of all is, of course, that known as Barentsz', inscribed 'Auctore Wilhelmo Bernardo,' and dated 1598. It was a posthumous publication, and the best that can be said of it is that it may have been drawn from materials left by Barentsz. A passage in De Veer's 'Three Voyages' must, however, be recalled, in which he describes how, just before Barentsz died, he "looked at my (De Veer's) little chart, *which I had made* touching our voyage, and we had some discussion about it." It is scarcely possible to avoid the suspicion that this may be the draft that was published as Barentsz'. It appeared for the first time in 1599, in the second part of the abridged Latin edition of Lindschoten's *Itinerarium*, published by Cornelius Claesz.

In this map there is an extraordinary blunder. The west coast of the island, which lies, in fact, almost in a straight line, north by west, is represented as bent at right angles, so that the part of the coast above the Foreland trends east-north-east instead of west-north-west, the direction of the part south of the Foreland. How the blunder arose we cannot now say; possibly from some written note in which east was set down (as not seldom happens) by mistake for west. This error was remarkably persistent. It is found on all sorts of maps, long after more correct and detailed surveys had been made, and it even infects such surveys. Thus, for instance, though Vischer's world-map of 1639 shows Spitsbergen fairly correctly, as then known, the younger Vischer, in his world-map of 1657, returns to the old Barentsz type of sixty years before.

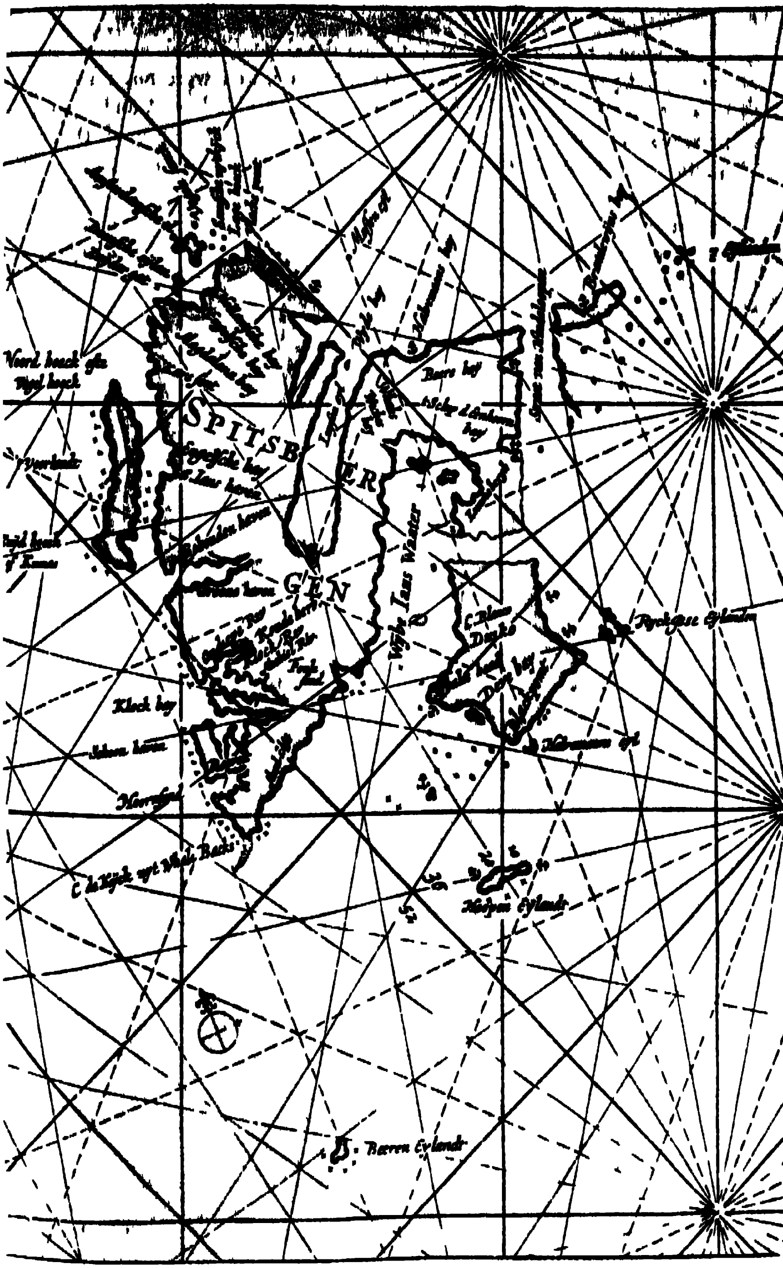
In the years immediately following the discovery the Barentsz type, of course, held the field. We find it on Franciscus Hoeius' map of the world of about 1600, in the Bodel Nyenhuis Collection at Leyden; and we find it on Wright's (commonly called Hakluyt's) map of 1600—"the new map" of Shakespeare's Twelfth Night. It appears, also, on the second state of Gerardus Mercator's map of the North Polar Regions, and on the Molyneux Globe in the library of the Middle Temple. It was used with little change by Jodocus Hondius in his History of Amsterdam (1611) and the Arctic map in 'Recentes Novi Orbis Historiæ' (Coloniæ Allob., 1612). It even appears on the globe engraved by Abraham Goos and published by J. Janssonius at Amsterdam in 1621, though in 1620, as we shall see, the same A. Goos had engraved a far superior map of Spitsbergen. In 1625 it was still the best representation known at Dieppe, where Jean Guérard published it as "Terre de Nieuwe Landt," in his 'Nouvelle Description hydrographique de tout le Monde.' It reappeared again and again in editions of Mercator's Atlas down to 1633, and even in 1657, as we have seen, it was still to the fore.

The first fairly truthful draft of the west coast was the chart known

as John Daniel's. The Muscovy Company from the first caused surveys to be made of the coasts explored by their servants, but they seem to have endeavoured to keep these surveys secret. Their expedition of 1611 did a good deal of exploration. Next year the first Dutch whaling ship went to Spitsbergen, under the command of Willem Cornelisz. van Muyden, piloted by an English deserter named Allen Sallowes, "a man imployed by the Muscovia Companie in the Northerne Seas for the space of twentie yeeres before; who, leaving his country for debt, was entertayned by the Hollanders, and imployed by them to bring them to Greenland [Spitsbergen] for their Pylot." Daniel's chart doubtless went over to Holland in Sallowes' pocket. Who Daniel was we do not know, but as the chart includes the Muscovy Company's discoveries of 1611, Daniel probably took part in the voyage of that year.

This chart was first published in 1613 by Hessel Gerritsz. at Amsterdam, in his polemical tract, entitled 'Histoire du pays nommé Spitsberghe,' where (p. 12) the following reference is made to it: "avons suivy pour la plus grand part les annotations des Angloys, tirés d'unne carte de Johan Daniel, escrite à Londres, l'an 1612." In this first edition of it most of the names are those given by the English. The next version of it, in which the names are those used by the Dutch, is that already referred to as engraved by A. Goos in 1620. It was drawn by Harmen and Marten Iansz of Edam, and published at Amsterdam in 1621 by Ian Eversz. Cloppenberg. The only example of it ('Nieuwe Pascaerte van . . . Europa') that I have seen was in Baron Nordenskiöld's collection, and has passed with it into the library of the University of Helsingfors. In addition to the west coast, as depicted by Daniels, it shows a small part of the north and east coasts, the mouth of Wybe Jans water, Swarthoeck away to the east, and Hope island south of it. That Swarthoeck was the south-west point of Edge island and on the east shore of Wybe Jans water, was not realized by the Dutch for a good many years. As late as 1660, when Edge island is well depicted (as in Arnold Colom's chart), Swarthoeck is duplicated as a separate island further away to the east.

The Dutch clung to this type also long after far better charts had been published. The original Daniel of Hessel Gerritsz. reappears in 1622 on a large terrestrial globe by Guljelmus Caesius, of which I found examples at Venice, in the Doge's Palace and the Correr Museum. We next find the same type, a little further developed, on a manuscript chart of 1628, drawn by Jean Guérard of Dieppe, and now preserved at Paris in the Départment des cartes et plans de la marine (Pf. 2, div. 1, p. 2). Then Joris Carolus, in 1834, introduced it, with a slight extension of the north coast, into his 'Het nieuw vermeerde Licht' (Amsterdam: Map 22, p. 147). In the following winter Vrolicq freely copied it on a vellum chart, which he used to illustrate his case against the Dutch. The corresponding Dutch case was supported by a large manuscript



KAART VAN SPITSBERGEN MET ALLE ZIJN ZEEKUSTEN ZOO VEEL TOT NOCH TOE BEKENT IS,
BY HENDRICK DONCKER 1663

chart, which belongs generally to the developed Daniel type of the period, but presents many small divergencies which were not repeated in later charts. It was drawn by Michiel Hsz. Middelhoven, and is now preserved in the Rijks Archief at the Hague. A number of Dutch pilots swore to its truthfulness. Let us hope they have been forgiven. Isaac Commelijn copied Daniel's chart, with the addition of mountains decoratively dotted about, into his 'Begin ende Voortgangh vande Nedolandtsche Oostindische Compagnie' (Amsterdam, 1644), and in so doing remembered to state that Daniel was his authority. Next year the same type turns up in Anthony Jacobsz.' edition of Carolus' atlas, and in 1648 in Jacob Aertsz. Colom's 'Der Vyerighe Colom' (Amsterdam), and it reappears in other publications of Colom's, printed and manuscript,* down to 1654. Other Amsterdam publishers made use of it—Pieter Goos and Cornelis de Leeuw in 1650, in a Pascaert (Brit. Mus. 982 (13)); Janssen, in another almost identical (Brit. Mus. 982 (11)); Willem Iansz. Blaeu, in his 'Zeespiegel' (Amsterdam, 1652, chart No. 48); and finally, as late as 1703, in the English translation of Constantin de Reneville's 'Voyages.' Such is the vitality of a cartographical type when once firmly established!

The Muscovy Company's servants no doubt brought home surveys year after year, but they have all disappeared save part of one. This is the lower half of a manuscript chart of the west coast, surveyed in 1613, apparently by R. Fotherby, and now preserved with his journal in the library of the American Antiquarian Society at Worcester, Mass. It is more accurate than the corresponding portion of the so-called Edge's map. Probably it went into the archives of the Muscovy Company, but it does not seem to have been given to the public.

The same Joris Carolus, who in 1634 published Daniel's chart with all its omissions to the eastward, had himself in 1614 explored the south coast of Edge island, and made a manuscript chart of it, which may still be seen at Paris in the Depôt des cartes et plans de la marine. This type was not reproduced, so far as I have been able to discover, not even by its own parent.

We now come in chronological sequence to the important map first published in 1625 in the third volume of Purchas' 'Pilgrimes,' reissued in 1631 in Pelham's 'God's Power and Providence,' and finally in the fourth volume of Churchill's 'Collection of Voyages' (1704–1732). This is generally and conveniently known as Edge's map, because it contains the result of his explorations, but it would be better to call it the Muscovy Company's map, for it is drawn from materials in the company's possession, and includes all the discoveries made by their servants up to the date of its appearance. It is far better than any previous map, and than most that followed it for half a century. It

* Manuscript chart in British Museum, S.T.A (2) f.

shows the west coasts of Barentsz. and Edge islands, the south point of North east Land, and, by marking Wiches Land, has given rise to much controversy. This is the last seventeenth-century British contribution to Spitsbergen topography. The Muscovy Company's servants continued their explorations from year to year for many years, but none of their observations have ever been published, nor have they survived. This Muscovy Company's map produced considerable influence upon foreign cartographers. A rude Italian copy of it appeared in 1630 in Sir Robert Dudley's 'Dell' Arcano del Mare' (Florence). This Spitsbergen type was next introduced into the polar chart in Hexham's

BLAEU'S MAP OF SPITSBERGEN, MAINLY AFTER EDGE. 1662

English edition of the Atlas of Mercator and Hondius of 1636, but till 1652 I cannot find that it was adopted in Holland. In Blaeu's Seespiegel, published in that year, though Hondius' polar chart is copied, the special map of Spitsbergen still adheres to Daniel's type.

It was the enterprising Hendrick Donker who first gave currency to a more developed Spitsbergen in his atlas in 1655, and it is possible that Purchas was not his authority. He also added a valuable local chart of Smeerenburg bay, afterwards copied by Van Loon (c. 1660) and by G. van Keulen (c. 1705–10). Jan Janssonius, the successor of Mercator and the Hondius, and the rival of the Blaeus, copied Blaeu's copy of Hexham's polar chart in 1657. Donker's type was adopted by

all the progressive Dutch publishers, such as Van Loon (c. 1660), Colom (c. 1660), and P. Goos (1662). The Blaeus, in 1662, went direct to Purchas' book and reproduced his Spitsbergen map with modifications on the north coast, and notably with the addition of Hinloopen strait. G. Valk and P. Schenk, about the same time, likewise issued a large chart in which many of the Blaeus' erroneous additions were removed and their place taken by a mere straight coast. Better still was Arnold Colom's Spitsbergen in his undated Nieuwe Pascaart, which we may ascribe to about 1662, where the bays in the north coast are for the first time approximately correct in number and relative position.

Thus far only the west coasts of Barentsz. and Edge islands had ever been delineated, and only the mouth of Wijde bay. In 1663, however, a new departure was made by Hendrik Doncker when he issued in his atlas (Brit. Mus. S. 4 (18)) the 'Paskaert van Spitsbergen met Alle zijn Zeekusten zoo veel tot noch toe Bekent is.' Here we are shown the whole depth of Wijde bay, all the west shore of Hindeloopen strait, and the east coasts of Barentsz. and Edge islands. We also find the Seven islands roughly marked, and part of North-east Land indicated. The Rijk Yse islands are also set down for the first time, though they are said to have been discovered twenty years before. This new type was presently copied by Pieter Goos in 'De Zee-Atlas ofte Water-woereld' of 1666. It reappeared in the Spanish edition of 1669 and in the English editions of 1669 and 1670. Spitsbergen is similarly depicted in a chart published after 1670 at Amsterdam by Jacobus Robijn (copy in my atlas at the Roy. Geog. Soc., London). We meet with it finally, produced on a larger scale by J. van Keulen in his atlas of 1687, and by G. van Keulen down to the time when he substituted the Giles and Reps chart for it about 1710.

When first observed it may seem surprising, but on reflection it will be found natural, that from the date of the publication of the Muscovy Company's map by Purchas in 1625 down to the issue of Scoresby's map in 1820, no original or improved chart was issued from England or as the result of English surveys. English whaling was first carried on by the Muscovy Company, who had reasons, or thought they had, for keeping their discoveries and surveys secret. It seems probable that their records were destroyed in the Fire of London—at any rate, they are not known to have been seen for more than two centuries. After their day was done, English whaling utterly declined. On the other hand, throughout the seventeenth and eighteenth centuries, whaling was one of the most energetically pursued Dutch industries. Thus all the new charts were Dutch, and such English Spitsbergen charts as were issued from time to time were belated copies of Dutch publications.

In the text accompanying the English atlas, published at Oxford by Moses Pitt (1680-83), it is written, "Had our men . . . been careful

to make Charts as our industrious Neighbours (the Dutch) oblige their shipmasters to do, divers discoveries had been asserted to this Nation, which are now almost disputed from us. The Dutch gave names . . . to places long before discovered by the English, as if themselves had been the finders." The polar chart that follows is practically a copy of that in Hexham's Mercator, and it seems as though the Oxford editor only knew of the Muscovy Company's survey through that Dutch medium, so completely was geographical research and compilation at that day dominated by the energetic Dutch publishers of maps.

In the year 1707, Giles, the Dutch whaling skipper, made his famous circumnavigation of the whole Spitsbergen group, and discovered the east coast of North-east Land with the islands off it, and especially Giles Land. Another skipper, Outger Reps by name, went over part, at all events, of the same ground, for his name is given to an island off the eastern part of the north coast of North-east Land. These two men, Giles and Rep, were evidently whalers of experience, and seem to have been regarded in their day as the best authorities on Spitsbergen geography. Accordingly, Gerard van Keulen, the enterprising map publisher of Amsterdam, employed them to produce for him an entirely new Spitsbergen chart on a much larger scale than any before published. The result was the 'Nieuwe Afteekening van Het Eyland Spits-bergen opgegeven door de Commandeurs Giles en Outger Rep en in't Ligt gebragt en uyt gegevon door Gerard van Keulen,' unfortunately without a date. This chart represents the high-water mark of the prescientific surveys of Spitsbergen. Almost every important feature of the coast is set down somehow, though with great inaccuracies in latitudes and longitudes. Some features are depicted which the modern charts wrongly ignore, as, for instance, the little bay of the Basques between Magdalena and Hamburger bays.* In point of nomenclature, Giles and Reps' chart is less valuable. Many of the old names had been forgotton, others transposed. Some sites were wrongly identified; as, for instance, that of the English settlement in Bell sound. But, on the whole, the chart is a very fine work for its date, and it was never superseded till the modern survey was made. Parry used it on his polar expedition in 1827, and bore witness to its rough general truthfulness. Van Keulen issued it on a smaller scale with the surrounding seas in his Oostersee Karten. Zorgdrager practically copied it with unimportant alterations in the various editions of his 'Bloeyende Opkomst der . . . Groenlandsche Visschery' of 1720 and later. It is unfortunate that Giles' own work should not be better recorded. Daines Barrington instituted inquiries about it, and put on record that Mr. C. Heidinger, publisher in the Strand, London, intended,

* This is marked on the map of the Yszee in Colom's atlas of 1656, and in many other charts mentioned above.

in 1775, to use Gillis's surveys (of which he had copies) "for a new and accurate map of Spitsbergen, for which he has collected many valuable materials, which he proposes to add to a new edition of his translation of Prof. Le Roy's 'Narrative of Four Russian Sailors.'" Heidinger published that narrative in 1774, but the proposed second edition and new map seem never to have been issued, and all the materials collected are lost.

R. van Wyck also freely copied the Giles and Reps' chart towards the end of the eighteenth century, making a further confusion in the names. His original manuscript drawing is preserved in the library of the New York Geographical Society, and there is an accurate tracing of it in my atlas at the Royal Geographical Society in London. A small engraved copy of it illustrates B. de Reste's 'Histoire des Pêches' (Paris, 1801, vol. iii. p. 79), and a large engraved copy is included in the portfolio accompanying R. G. Bennet and J. Van Wijk's 'Verhandlung over de Nederlandsche Ontdekkingen,' etc. (Utrecht, 1827). Zorgdrager's version of the Giles and Reps' chart finally served as foundation for the map introduced by Scoresby to illustrate his 'Arctic Regions' (London, 1820), the chief difference between the two being that Scoresby, by compressing the longitudes approximately to their just extent, made the general contour of the west island fairly correct.

In conclusion, I may perhaps be pardoned for stating that the above short and dry summary contains the pith of nearly seven years' study of the subject. During that time I have ransacked most of the collections of charts in Europe likely to contain early maps of Spitsbergen, and I have traced every one that was not merely a direct copy of some other already known to me. I have been fortunate in obtaining permission to photograph some of the rarest. Finally, I recently had the good luck to acquire by purchase seven or eight examples of some of the most important charts mentioned above. The collection of tracings, photographs, and originals thus formed has been bound in a volume, which I have deposited in the library of the Royal Geographical Society. The subject is not, of course, either of much general interest or of great historical importance, but it is possible that the existence and accessibility of my 'Historical Atlas of Spitsbergen' may suggest to some other student an interesting line of investigation which can be applied to any other district or country in the world. Nothing shows more plainly the slow growth and temporary decay of knowledge of a district than the juxtaposition of the various maps of it, issued at successive dates.

BASUTOLAND AND THE BASUTO.*

By Captain R. CRAWSHAY.

What is so commonly said of the people of Great Britain, that they do not know their own country, is more applicable to South Africa in general, and to Basutoland in particular, from without as well as within. If you question any ordinary ten people of the whites of our South African colonies as to what they take Basutoland to be, nine out of the ten will reply, "Why, part of Cape Colony." Question them further as to whether it is under the government of Cape Colony or not, and probably they will reply scornfully, "How otherwise?" It is no exaggeration to say that from without in South Africa the ignorance prevailing in regard to Basutoland is astounding, and that within—with few exceptions—the whites do not know the correct native names or heights of mountains in sight and easy reach of which they have been living for years. As always in such countries, it is the missionaries who know most.

During ten months, in 1901–1902, I happened to be employed by Remounts in purchasing horses in South Basutoland. In this capacity, making Maseru my headquarters, I travelled over 2000 miles on horseback, by road and bridle-path, so had good opportunities of seeing something of the country and people from an outside point of view. By request, I now endeavour to record my impressions, which, given freely and frankly, "without partiality, favour, or affection," will, I hope, be taken in the spirit in which they are offered.

The Basutoland Protectorate—or Lesuto, as its people know it—has well been styled the Switzerland of South Africa. This is not as applicable to the western as to the eastern portion; nor is it at once remarkable on the 90-miles journey from Bloemfontein, the capital of the Orange River Colony, to the western border, because the change in the intervening country is gradual—from at first almost a dead open flat, relieved only by occasional low stony hills, to mountain and flat about equally proportioned. It is with Southern Basutoland that I have acquaintance, by which I mean from Maseru, the capital, to Kuthing, south of the Orange river, a distance of some 130 miles. This constitutes a country unique, probably, to all South Africa—densely populated, much cultivated, full of live stock; so much so, indeed, that there is not a foot of spare land. The monotony of the bare highland prairies of South Africa is not apparent in Basutoland, for here the face of nature changes at every turn. In all directions are mountains of striking contour—this one with a sugar-loaf peak—Machachi, that one with a flat saddle-back, from which rise potato-like excrescences—

* Strictly speaking, "Basotho," as a noun of Class I. I observe the rule of the Society in retaining existing spelling, to avoid confusion.—R. C.

Thaba Ntelle, another with a beak-like rostrum protruding at right angles into space—Kheme, the majority crowned with frowning precipices, but all with their upper slopes studded with boulders, and in most cases their summits of solid rock. There is a personality about each which makes one inquire its name.

Maseru is scattered over the slopes of several small hills within the bend of the Caledon river, here forming the western boundary of the Protectorate. Here reside the Resident Commissioner with his principal officials. The remaining white population consist of the clergyman, manager of the Standard Bank, the proprietors and employés of four trading stores, a saddler, and the usual complement of carpenter-blacksmiths, who combine their third calling of lodging-house keepers as well. The native population is considerable and undesirable, owing to their disregard for sanitation.

For the purpose of administration, the country is divided into districts under assistant commissioners. The towns where these officials reside constitute, as it were, European reserves, where the white officials hold sway, whereas outside the chiefs are responsible for what goes on, subject to direction from the officials. The control exercised over the natives is of a dual nature—on the one hand European, on the other that of the chiefs, who retain practically supreme power over their people. It is not an infrequent occurrence for a man to be "eaten up" —that is, have all his property confiscated—by his chief, for perhaps a trivial offence. Power such as this is open to abuse; but were it taken from the chiefs, their medium would be unavailing to control their people. It may be fairly claimed for Basutoland that, if not strongly governed, it is yet governed—as it is believed—in the first interests of natives, by a resident commissioner, who, whatever may be the views held by the whites of South Africa as a whole, will not, if he knows it, see his people suffer injustice.

No one visiting the country for the first time, more especially if he be one who has seen much of other parts of South Africa, can fail to note what an object lesson it affords of the development of practical enterprise on the part of the African native.

Following the road south to the southernmost border, you pass through almost one continuous stretch of maize, wheat, oats, or sorghum, according to the time of year. No sooner is one crop out of the ground than another is put in. No manure is used, so cultivation goes on until the land exhausts itself, when there is nothing for it but to let it lie fallow to recover. It is surprising that, having attained so far, the Basuto have not attained further, in returning to the land the refuse of the crops in the shape of straw, instead of burning this on the clearings where the grain is threshed by the primitive method of beating it with sticks.

All cultivation—with rare exceptions—is done by the plough, drawn

either by oxen or ponies. Hoes are used for cleaning the crops, sickles for reaping. The men do the ploughing, harrowing, and sowing; men and women the hoeing and harvesting. Nothing could be more picturesque than the ordinary prospect in Basutoland, the rich green crops on the lowlands, the live stock grazing over the slopes, and the villages perched up amongst the crags, commanding a view of all below. In the spring or summer, when the air is clear, the contrast of colours in the green herbage, the brown houses, and the reddish-brown rocks resembles a peep into fairyland. At the same time, distance lends enchantment to the view, for the average Basuto are as filthy in their habitations and food as the wildest tribes of the interior—more so, indeed, in food than almost any people I have come across. An ordinary village consists of from less than half a dozen huts to, in the case of a chief, forty or fifty. The huts are of stone, thatched with grass. Many are rectangular, of good size, especially those of the chiefs, and in a few cases roofed with corrugated iron. The majority are circular, some 10 feet in diameter, with a fairly decent door, and perhaps one or more windows, ranging from mere holes blocked by a single stone or rag, to others 2 or 3 feet high by 2 feet broad. A reed fence forms a sort of courtyard to each hut, or perhaps several huts, the doorway hung with an old sack as often as not, and leading out on to the refuse mound, the accumulation perhaps of years. The precincts are impossibly filthy—bones, hoofs, horns, and other refuse lie about everywhere. In every village there are one or more "kraals" built of stone, in which at nights the live stock are kept.

In live stock and poultry the Basuto are distinctly well off; they have horses, asses, cattle, pigs, sheep, goats of several breeds, including the Angora, turkeys, geese, ducks, fowls, pigeons, and occasionally guinea-fowl. A few of the chiefs have ostriches—a standing grievance to the people on whose crops they batten. On, or rather partially *in*, the ground are built little shelters of stone for the poultry, each large enough to accommodate a sitting bird. As all wild carnivora, and indeed all mammals larger than a mole, have been exterminated in the inhabited districts, the defenceless occupants are not molested. Dogs are the plague of the country—curs of every description, some showing a grotesque likeness to such noble ancestors as mastiffs, St. Bernard's, setters, and pointers; the majority of the ginger-coloured, prick-eared, sharp-nosed, curly-tailed type usually in favour with the African.

At one time, probably, the country was wooded with dwarf forest; now it is absolutely bare, except for scrub and heather high up in the mountains. The only fuel in use is the dung of cattle, the collecting and drying of which is a chief industry of the Basuto women all the year round. In the inhabited districts, there is no undergrowth larger than the wild raspberry and blackberry, both of which are widely distributed. There is no bracken—at least, I have seen none. A

conspicuous flower in the low country is a dark-red wild zinya, in colonies here and there. Trefoils grow luxuriantly in most places, the commonest being one with a brilliant dark crimson flower, and leaves no larger than the shamrock. The British buttercup and red poppy are everywhere.

Nowhere in the world is there a country more destitute of game, furred or feathered. Follow the roads or bridle-paths, ride wide of these anywhere in the inhabited regions, and in 50 miles you will not see as much as a dropping of a hare or francolin. Everything in this way has been exterminated. Quail (*C. capensis*), being migratory, are to be had in their season in fair numbers, though mercilessly persecuted by men, boys, and dogs. A lovely blue rock pigeon (*Phœonota vinacea*) is fairly abundant, by reason of its haunts in the precipices being inaccessible. High up in the mountains *Pelea capreolus* (a small grey antelope) are fairly plentiful, though difficult of approach by reason of their goat-like haunts and habits, and their extraordinary powers of vision and hearing. Baboons inhabit such mountains as Machachi, though what they subsist on is a mystery. A fair bag of francolins and hares can be had on the higher mountains intervening between the native locations. In the low countries, on newly ploughed land, I have several times seen small flocks of ibis. A common and very confiding bird of prey seen everywhere, very often on the telegraph wires, is a small, beautifully coloured terracotta-red and French-grey kestrel. The hooded raven is as ubiquitous as in most African countries. Another species, all black and of lighter build, is especially amusing to watch, with his merry gurgling crow and dancing antics. During my stay in Maseru, I twice remarked a pair of large owls (*Bubo verreauxi*) in the eucalyptus and wattle plantation known as "Hades." Widow finches are very numerous, and destructive to crops. Larks and creeping warblers are the commonest birds in the open country. Bulbuls and sparrows are plentiful in the townships, where they levy heavy toll on the fruit. Rollers, hoopoes, and nightjars are very rarely seen. A few duck are to be seen now and again on out-of-the-way pools. It is not a snipe country. On the little-known slopes of the Drakensberg, on the eastern border, there are rumoured to be such mighty antelopes as the eland and hartebeeste, also leopards and other carnivora. Snakes are very rarely met with, if I am to judge from my own experience. I collected one harmless species at 10,000 feet on Machachi, which Mr. Boulenger determines as *Amplorhinus multimaculatus*, one of the Psammophidæ, or sand-snakes; perhaps I saw the sloughs of about two more found in the lowlands. Two species of diptera—an Æstrid and a pupiparous species—are parasitic on horses chiefly. *Gastrophilus equi* reproduces its species in the ordinary way, by depositing its ova on the hairs of the forehand, whence they are bitten off by the host, swallowed, and matured as larvæ in the stomach. *Hippobosca rufipes* has a more remarkable life-history, as given me by Mr. E. E. Austen, of the Natural

History Museum: "The female produces a single living larva at a time, the lava attaining full growth within the body of the mother by means of a sort of placental connection with the wall of the oviduct. On being extruded, the larva at once pupates, in consequence of which the group of flies to which *Hippobosca* belongs has been termed Pupipara." There is much to be done for entomology in the highlands, and even in the lowlands, in the less-known orders. In fact, I think up to the time of my visit nothing in this way had been collected, except Rhopalocera by Mr. Trimen long ago. Quite a number of my Heterocera proved new; also one Rhopaloceron, taken high up in the mountains, a good many Hymenoptera, and one large Arachnid, described by Mr. R. I. Pocock. The only land-shell so far recorded from Basutoland is one from Machachi, described by Mr. Edgar Smith as *Achatina Machachensis*, n. sp.

The Basuto deserve every credit for their energy and industry in agricultural development, even though the motive be *money* wherewith to purchase live stock and wives. But when this has been said for them, with the exception of such enlightened chiefs as Jonathan Molapo and those of the younger generation who have been highly educated by the missionaries, they are far below the natives of the interior in that healthy morale which characterizes wild men.

All who have travelled in the interior of Africa will have experienced the extraordinary hospitality of its peoples, though it may be not all at once, perhaps, because either the strangers are objects of terror or suspicion, or because they will precipitate hostilities by helping themselves to what they find without first exchanging—what very often are the most absurd—preliminary courtesies, or for some other reason. Invariably, when once friendly relations have been established, hospitality is met with everywhere; whatever the people have in the shape of food they bring—fowls, eggs, vegetables, grain; in the case of chiefs, a goat, a sheep, or a bullock. If such hospitality is withheld, it is considered hostility—in fact, a declaration of war, if not explained. During my time in Basutoland, it often happened that I slept out where night overtook me, sometimes without a bite of food or drink, but never once did a native offer me anything, nor would they sell me as much as an egg at any price. On the other hand, from their chiefs downwards, they were not ashamed to beg. Nsani of Maseru came to me to beg meat from the carcase of a Government horse on which I was holding a post-mortem.

A fair test of the African's status as a man is the standard of virtue prevailing amongst his female kind. It used to be said of the Amazulu, "A waggon-load of trade goods will not buy the dishonour of a woman!" The same applied to the Nyasa tribes in days gone by. Doubtless it still holds good, except in the case of abandoned women in the neighbourhood of European settlements. It cannot be said of

tho Basuto women, whose immorality is without restraint. What a contrast to the women of the interior, whose modesty is such that, even when in a European's employ for quite a time, they will rarely address a word to him on any matter however urgent, nor can they readily be brought to reply to a question addressed to them in connection with their work or pay! The result of this polyandrous propensity on the part of the Basuto women is that disease is exceedingly prevalent.

The Basuto possess almost none of that interest which attaches to wild men. Their natural habits, the outcome of instinct, have been lost from contact with whites, whose vices they have absorbed, without their virtues. The first impression one has of them is that they are a mongrel race, not Bantu, but a cross between these and some xanthous people of South Africa, with perhaps some European blood as well. All colours are they—bronze, yellow, and yellowish-white. A common feature noticeable amongst them is a long hooked nose, of Semitic shape above, having the squat tip and wide-open orifices of the negro. Some have hatchet faces, beetle brows, lantern jaws, thin lips, or almost almond-shaped eyes. Bishop Steere's definition of a "nigger" as opposed to a "native" used to be "a native in European clothing." Dress up a negro with a view to making him as grotesque a figure as possible, and you have a very fair idea of the ordinary Mosuto. A tawdry multi-coloured woollen night-cap with a bobbin-like tassel is worn, pulled down over the head, covering the brow, the ears—as often as not—and the nape of the neck. The only upper garment of any sort is a coloured woollen blanket or shawl with fringes, worn humped over the shoulders, where it is pinned by a safety-pin about 6 inches long, specially imported for the purpose. Below this are trousers, tattered and plastered with patches of cloth of all kinds, retained in position by a money-belt, or it may be braces. Clumsy boots, with or without putties, or bandages of rags, complete the illusion. Figures such as these throng the towns and elbow and jostle one another in the stores, or are to be met on the roads and paths, perched on the backs of unkempt ponies. No Mosuto will walk a yard if he can help it; failing a pony or donkey, they will ride an ox or a cow, small boys at play even a goat.

The dress of the women resembles rather that of the Dutch. On their heads they wear coloured handkerchiefs tied under the chin, bright colours, such as orange, yellow, and green, being in especial demand. The only other garment is a plain print dress, with a shawl over the shoulders. Women living in the towns as a rule wear stockings and shoes.

The above description applies only to the Basuto as a whole. In the case of some chiefs and of the educated members of the tribe, their dress is identical with that of the European in the *minutest detail*, even to high linen collars.

European settlements are a pleasing contrast to other parts of the country, for they are green oases in an otherwise treeless waste. Many European timber trees and all fruit trees thrive well with little care. The oak grows as luxuriantly and twice as fast as in Great Britain, bearing acorns more than double the normal size. Its timber is not as hard, owing to its quicker growth. Scotch firs—indeed, all firs—do particularly well; also the walnut, Spanish chestnut, beech, mountain ash, and black poplar. The willow does well in moist land. I was disappointed not to see either the elm or the lime. In the residency garden at Maseru there are many familiar shrubs from home, including lilac, laurel, box, and syringa. Common creepers on the houses of Europeans are jasmine (white and yellow), honeysuckle, clematis, and passion flower. Privet as a fence grows with great vigour, a mass of strong-smelling flower in the summer. The quince also is largely utilized for fences, so that, with its handsome and highly edible bright yellow fruit, it is as profitable as conspicuously pretty. Fences of cherry are occasionally seen; one in particular do I remember in the Government secretary's garden, which provided more than one cherry tart for the police mess. Owing to the complete rest afforded by the hard winter, stone fruits grow anyhow, bearing crops so heavy as to cause their branches to split under the weight. There are apricots, peaches, nectarines, a few plums, greengages, pears, apples, mulberries, figs, and grapes, not always, it may be, producing fruit of the best *quality*, but in astounding *quantity*. Never anywhere have I seen heavier crops of apricots than on some of the trees in the police mess garden at Maseru. Bush fruits I saw none, except two stunted gooseberry bushes in the garden at Motsekuwa. The strawberry is widely distributed. The winters are too severe for such tropical fruits as the banana, the paw-paw, and the custard apple. Lemons do very well at Moriya; oranges are nowhere a success. Vegetables are somewhat disappointing—perhaps because they do not receive sufficient care. Cauliflowers, cabbages, Jerusalem artichokes, beans, and asparagus are about the best. Potatoes, as a rule, are very poor.

The *great mistake* made hitherto in timber-planting in Basutoland has been the universal introduction of the eucalyptus, with its known tendency to desiccate—in a country already too dry—and to poison all other vegetable growth in its vicinity. The Australian wattle would have been preferable.

Firs would have been best of all, for, though slow growers, they thrive capitally, and, shedding their spines, these retain the moisture in the soil after the manner of cocoanut-fibre.

Much has been written of the pony of the country—that he is a paragon of soundness, of bottomless endurance, worth any money. After ten months' purchasing for army requirements, my experience is, the first qualification is rarely met with in adult animals; the second

results from the spartan rearing, involving the survival of only the fittest; and, granted the two first, the third follows as a matter of course. The Mosuto—after the manner of the native—is a bad master to his beast, using him hardly, working him as if regardless of his being flesh and blood, and begrudging him any other food than such grass as he is able to pick up for himself. No compassion is shown for either extreme youth or old age.

By far the most interesting portion of the Protectorate is the mountainous eastern half, commencing about 30 miles east of Maseru, and extending to the Natal border. Unfortunately, having my duty to do, the most I was able to do was to enter the promised land—in other words, to make the ascent of Mount Machachi and put in three days on its slopes. This had been reported to me to be the highest mountain in the country, 11,000 feet; but I was afterwards assured by the Rev. R. H. Dyke, of Moriya, whose father was the pioneer Huguenot missionary in, I think, 1844, that Mount Hamilton, on the eastern border, is considerably higher—over 12,000 feet, and that Machachi is not as much as is believed by the Protectorate officials.

Leaving my spare horses and mules at a point about 7 miles from the foot of the mountain, and using two ponies for our packs, myself and servant, with two natives, walked to the base, and the next morning climbed the mountain by a fairly good, though steep, circuitous track to a col some 800 or 1000 feet from the summit, where we put in two nights in the open. It was in the rainy season, but, with the exception of the first night, the weather was fine, though cold and boisterous.

From the bare ill-watered lowlands to the slopes of Machachi, with its abundant clear cold streams, its invigorating atmosphere, its profusion of wild flowers, and new forms of insect and animal life at every turn, was indeed a delightful change. About half its time the rocky peak is hidden in the clouds. During the cold season the snow lies for weeks and months on the upper slopes.

Pelea capreolus are tolerably plentiful at the higher altitudes, and I was glad to have this opportunity of observing them. Like goats, they look for danger from below, not from above. From the nature of the country they frequent they are difficult to approach, for the slopes are open, steep, and covered with loose stone, and, sound travelling readily, the least noise made by displacing a stone tells its tale. Then from the slope above or across a valley comes the weird cry of alarm—"Haa!"—from a buck standing motionless amongst rocks the colour of his coat. I have tried to locate the whereabouts of a buck for several minutes, during which he has periodically uttered his alarm, but have not been able to distinguish him until, in turning to go, his white tail betrays his form. High up on the mountain I remarked a field rat with large ears, of which I could not secure a specimen, having neither a gun nor a trap.

Wild flowers are in *extraordinary* profusion—heaths, ixia, gladioli, hyacinths, primulæ, carnations of *tiny* size, meadow orchids, gerania, and ferns.

The summit of Machachi is of solid rock, in process of disintegration in the alternating heat and frost. Dr. Flett, of the Geological Survey Museum, has determined a specimen of this to be amygdaloidal lava, containing apophyllite and prehnite, coated with dark green chlorite. Another rock from 1000 feet lower altitude is pronounced by the same authority to be ophitic olivine dolerite reddened by decomposition.

All over the mountain there are abundant streams of the clearest water possible, often flowing over beds or through basins of solid rock. Water oozes from under the rocks within 150 feet of the summit.

Parts of the mountain are sheer precipice, especially to the north-west and north-east. From the summit, looking eastward, the view is one of magnificent and weird grandeur, a knotted mass of mountains, little inferior to Machachi, the contour of which no man's eye could define. In the opposite direction, the vast expanse of what in comparison is flat country lacks salient features on this account, and, at the time I viewed it, was much obscured by the lowland haze.

Much has been written in reports of the richness of Basutoland as a grain country, producing for its size more maize and wheat than any other part of South Africa. If this is to be maintained in the future, some effective scheme must be evolved to preserve the rainfall for the land, and prevent the wholesale wash off and wash out of the Earth's surface ever increasingly going on. In the neighbourhood of towns, on the roads and tracks, and on slopes denuded of vegetation, watercourses are formed—at first the merest crevasses, ultimately becoming huge ravines 30 or 40 feet wide and 20 deep, which receive the rainfall of a large area of land, bearing this away with little or no benefit to the land drained, at the same time washing off its top soil in doing so, besides carrying away huge masses of earth from the banks of the ravines themselves. What is wanted is to arrest the growth of such water-courses where formed, and to prevent their formation by enabling the land to absorb its rain, which may be done by not denuding it of its grass—better still, by planting timber. It is, of course, hopeless to look to native enterprise to do anything in this way. Therefore it can only be done by Government, with funds raised by taxation.

Bridges are badly wanted across the Great Caledon river (where, when the river is very high, the pont cannot work), the Little Caledon river, and the Makhaleng river on the north of Mohaleshoek, which, in the rainy season, delay traffic for days on end, causing loss of property and sometimes loss of life as well.

It is late somewhat to legislate for contagious diseases, but much good might yet result from this, in the case of man and beast. No country in all Africa could be better off in facilities offered to the

natives to educate themselves. There are mission stations at every few miles—those of the Church of England with its headquarters at Masite, the Roman Church, and, most numerous of all, the French Protestant Mission with its headquarters at Moriya. All are deserving of the greatest credit for the pitch of education to which so many of the young Basuto have attained.

No man could desire a healthier or pleasanter climate than that of Basutoland. It nearly resembles what that master man and mind, Sir Richard Burton, has termed the "champagne air of the desert." Never does one experience any sensation of lassitude. It is hot in the hot season, though not oppressively so. During the summer I was thére, the maximum temperature in the low country, *i.e.* 5000 to 5500 feet, did not, I think, exceed 94°. The cold is proportionately much greater, 15° to 20° of frost not being uncommon, accompanied by hail, snow, and cutting winds, fatal alike to man and beast. In June, 1902, there was just such a spell of cruel weather—hail, snow, rain, wind, and frost, in conjunction or rapid succession, productive of wholesale disaster. There were reported to have died from exposure to it, between Aliwal north and the south-west border of Basutoland, some twenty-eight natives. There was hardly an owner of live stock in the country who did not suffer heavily. For quite a fortnight the snow lay at Mafeteng, altitude about 5100 feet. As is only to be expected from the conformity of the country, there are terrific thunderstorms in the hot season. If the traveller comes in for one in the Moriya-Masite-Kheme valley, he cannot fail to be impressed by the awful grandeur of the elements—the inky black masses of clouds rushing together from over the mountain-tops, the lurid lightning thrilling him to his marrow, the deafening thunder exploding and, as it were, splitting the rocks on the slopes above, the rain and wind which he and his horse cannot face. For the time being, he realizes what it is to feel *at the mercy of the Creator*. Luckily, such storms are of short duration; thirty minutes and the worst is over. The difficulty then is the impassability of the streams and watercourses, to say nothing of the slippery state of the paths.

The Sesuto Language.

On first hearing Sesuto spoken, it appears not to be a Bantu tongue. On closer acquaintance, there can be no doubt it is, though of another class to that of the tribes of equatorial Africa. It abounds in the letters *h* and *o*. Many words end in *-ng*.

Seven classes of nouns only are admitted in what is at present the standard grammar, compiled by Mabille and Jacottet. Myself, I should be inclined to revise these by altering the prefix of one, and by adding three more classes:—

Class I.—Prefix: sing. "mo-," pl. "ba-": motho, batho, = person.

Class II.—Prefix: sing. "mo-," pl. "me-": motsi, metsi, = village.

Class III.—Prefix: sing. "le-," pl. "ma-": leiba, maiba, = blue rock pigeon.

CLASS IV.—Prefix: sing. "se-," pl. "li-": seolo, liolo, = ant-hill.
CLASS V.—Prefix: sing. "bo-," pl. "ma-": bosiu, masiu, = night.
CLASS VI.—Having no prefix in the singular: ntsintsi, dintsintsi, = fly.
CLASS VII.—Having irregular plural: leihlo, mahlo, = eye; leino, meno, = tooth.
CLASS VIII.—Having no prefix: metsi, = water.
CLASS IX.—Infinitives of verbs: "ho" · ho palama, = to ride, riding.
CLASS X.—Locative: "ha."
I am indebted to Sir Harry Johnston for the insertion of Class X.

A few common verbs are—

Ho ya	= to eat.	Ho hela	= to cut grass.
„ nwa	= „ drink.	„ thiba	= „ stop.
„ tlisa	= „ bring.	„ bitsa	= „ call.
„ tlosa	= „ take away.	„ lema	= „ cultivate.

At a person's is expressed by "ha." "Ha Bereng" = "At Bereng's." At, on, or in a place, by a suffix ending in *-ng*: "Thabaneng" = "On the hill." The usual greeting is "Dumela!" or if addressed to a chief or European, "Dumela Morena!" "I trust you, chief!" to which the reply is a long-drawn "E—E—E!" This, as a rule, is followed by the question, "U ea kae?" = "Where are you going?"

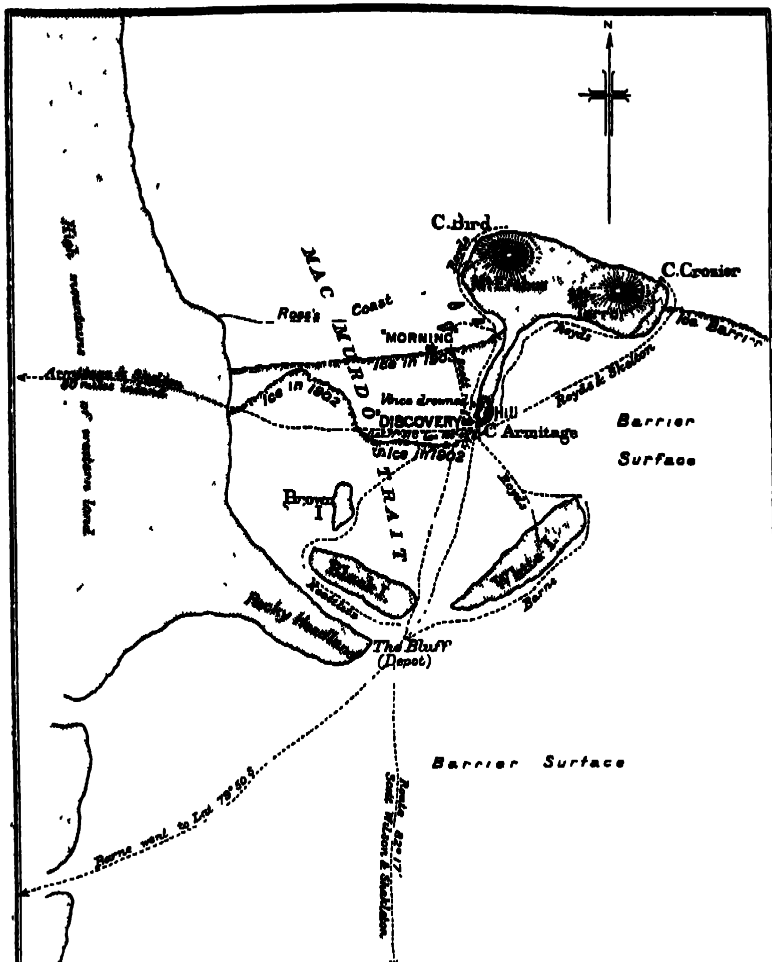
As a people, the Basuto are impertinently inquisitive, questioning one or one's followers on meeting, continuing this until they have passed out of earshot, or even accompanying one some distance to do so. Many hundreds of times have I been obliged to rid myself of noisy inquirers by telling them to go their way and leave me to go mine. A common practice is to ask for matches—even to stop one expressly for the purpose, by shouting from a distance.

From this, and from their general behaviour to Europeans in a hundred other ways, it is obvious they have not that respect for them which, from contact with the tribes of the interior, and even the Zulus, one has come to expect. Familiarity with the lowest class of white, some of whom are to be found in Basutoland, has bred contempt.

THE ANTARCTIC EXPEDITION.

THE mails which reached this country during the month of May have brought numerous private letters from members of the British Antarctic Expedition as well as the official report of Captain Scott. The latter will form the basis of the communication to be made by the President at the meeting of June 10, on the results of the first season's work in the Antarctic; but various details, supplementing those previously published, are to be gathered from the letters above alluded to, extracts from which have been published in the public press. The fuller information thus available confirms in the most satisfactory manner the favourable impression conveyed by the original telegram as to the results attained, both at the base station and during the various sledge expeditions. Among the most important geographical results,

in addition to those previously mentioned, are, in the first place, the discovery that Mounts Erebus and Terror form part of a comparatively small island, the so-called McMurdo bay being in reality a strait; and in the second the establishment of the fact that a great continental mass of inland ice extends westward a considerable distance from the coast,



ROUGH SKETCH BY LIEUT. C. W. R. ROYDS, SHOWING THE POSITION OF EREBUS AND TERROR ISLAND AND THE WINTER QUARTERS OF THE "DISCOVERY."

at an altitude of 9000 feet. It was during the sledge expedition of Lieut. Armitage and Lieut. Skelton that this ice-sheet was ascended, the accomplishment of the feat entailing the greatest difficulties. The party had no dogs, and were obliged to drag their own sledges, which

had to be continually unloaded, lowered down into crevasses 50 to 60 feet deep, and hauled up on the other side. Arrived at the summit, one man suffered severely from the rarefied air. The extensive character of the land discovered during Captain Scott's southward sledge journey seems fully borne out by the further details received, and the mountain ranges which traverse it are said to reach a height of 14,000 feet. It appears that the land discovered at the eastern end of the ice-barrier is distinct from the southward extension of Victoria Land, and Captain Scott proposes to name it King Edward VII. Land.

As regards the voyage of the *Morning*, and the meeting with the *Discovery*, it is stated that the antarctic circle was crossed on Christmas Day, three weeks after leaving Lyttelton, two islands being discovered the same day. On January 3 Victoria Land was sighted, but it was not until the 8th that a landing was effected at Cape Adare. Proceeding through heavily packed ice, a party landed at Possession island, which was covered with penguins. A wide track had been made by the birds to the centre of the island, the larger stones being removed from the paths. In the neighbourhood of Wood bay and Coulman island the ice was especially heavy. On January 14, a landing-party left a record at Franklin island, and four days later letters from Captain Scott, which had been deposited at Cape Crozier, were taken off. The *Morning* continued to force her way through the pack, and on January 23 sighted the *Discovery*, which was separated from the relief ship by 10 miles of fast ice, so that the two expeditions effected a junction by means of sledges. Subsequently some of the ice broke away, and by February 28 the distance between the two ships was reduced to 5 miles; but not even the heaviest gales did anything to further break up the intervening ice-fields. Captain Scott considers that the season was exceptionally bad, for last year, after the one year's ice originally found at the spot had broken away, the water remained open for at least six weeks. At the time of writing, shortly before the departure of the *Morning*, the weather was getting much colder and more blustering. The leader regretted the enforced detention principally on account of the waste of time, for all the party remained as keen as ever, and had it been possible to return to New Zealand this season, he had fully intended, if possible, to return for a third season's work. He says that it would be difficult to imagine a happier or more comfortable community, though the relief party saw evident traces, in the appearance of the explorers, of the hardships they had undergone, the men looking years older than when they set out. The position of the winter quarters was in 77° 51′ S., 166° 42′ E.

Among the incidents and personal adventures described in the correspondence, one of the most striking is the experience of a young New Zealander on the *Discovery's* staff—Hare by name. He formed one of the party sent out in March, 1902, to deposit a record at Cape

Crozier, which, as already mentioned, was overtaken by a blizzard when not more than 10 miles from the ship during the homeward journey. Hare became separated from the rest of the party, and, becoming exhausted in his fruitless search for the track, fell asleep in the snow. He remained asleep thirty-six hours, being soon buried in a snowdrift; but, strange to say, awoke on the second day little the worse for his hazardous adventure. It was during this same blizzard that the seaman Vince lost his life, the party with which he was having unwittingly approached a precipice, down which, being the foremost, he must have been precipitated, no trace being discovered of the missing man by the search-parties sent out from the ship.

The scientific observations have been carried on throughout with great thoroughness, over twelve months' continuous work being done at the winter quarters, in addition to a considerable amount of magnetic work, soundings, dredging, etc., at sea. Mr. Bernacchi thus describes the work accomplished in the field of terrestrial magnetism. "All the international term-days have been kept. The curves are unique and of a most interesting nature. The very large annual variation in the elements is perhaps the most conspicuous thing, but it is the individual curve that is so interesting. . . . We have something like 400 magnetograms. . . . The seismograph has been working the whole year, but very few shocks and tremors are recorded. Our largest are on May 25 and September 22, which seems to correspond with your record on April 18. There are some irregularities in the line, which might be due to the Guatemalan earthquake. . . . I have also a year's observations of atmospheric electricity." The lowest temperature recorded during the winter was -60° Fahr., or 92° of frost.

REVIEWS.

EUROPE.

The Coal-fields of Scotland.

'The Coal-fields of Scotland.' By Robert W. Dron, A.M.I.C.E. London: Blackie & Son. 1902.

In a volume under this title, extending to upwards of 360 pages, and illustrated with sixteen plates giving geological maps and sections, besides woodcuts in the text, the author deals in succession with the coal-fields of all the coal-producing counties of Scotland. There is also a general chapter on the Carboniferous Formation as developed in Scotland, one on the Lothian Oil Shales, one on Undersea Coal, and one on the Duration of the Scottish Coal-fields. This last contains a variety of historical and statistical matter, the statistics being necessarily to a large extent conjectural. In an elaborate table on pp. 326–398, prepared by the author about 1899, and originally published in the *Transactions of the Institute of Mining Engineers*, vol. xviii., particulars are given as to the estimated quantity of coal originally available in every coal-working district in Scotland, a distinction

being made between what the compiler calls "proven coal" and "reserve coal." Under the head of "proven coal" are included all the known workable seams of 2 feet thick and over, while under that of "reserve coal" the author has reckoned all the seams from 1 foot to 2 feet in thickness and all the seams of the Carboniferous Limestone lying beneath the Millstone Grit. Taking as his basis data contained in the report of the last Royal Commission on coal, he has then calculated the total quantity of that coal that has already been worked, and has arrived at the conclusion that there remain in round numbers 4635 millions of tons of "proven coal at moderate depths" still available, besides 5994 millions of tons of thin and deep seams. In this latter quantity are included one thousand millions of tons under the Firth of Forth, the author taking a different view from Dr. Hull in his book on 'Our Coal Resources,' where the opinion is expressed that coal-mining under the Firth of Forth is impracticable on a large scale on account of the danger from water. Undersea workings are already carried on from Buckhaven, Wemyss, and elsewhere on the Fife shore, and preparations are being made to test the workableness of the undersea coal near Cockenzie in Haddingtonshire, a company having leased from the Crown the coal for 2 miles under the Firth of Forth at that point. Mr. Dron thinks that a fairly safe allowance for the extent of coal that may be worked underneath that inlet is 3 miles from each coast. According to returns which have been collected since 1876, the coal raised in Scotland in the last quarter of last century was produced by the different counties in the following proportions:—

Counties.	Per cent.	Counties.	Per cent.
Lanark	55·90	Clackmannan	1·40
Ayr	14·35	Dumbarton	1·40
Fife and Kinross	11·95	Haddington	1·20
Stirling	6·05	Dumfries and minor producing counties	0·85
Edinburgh	3 75	Renfrew	0·35
Linlithgow	2·80		

The Lanarkshire production is still rapidly progressive, but Mr. Dron thinks that in twelve or fifteen years the most easily wrought seams of that county will be approaching exhaustion, and that the manufacturers of the west of Scotland will thus be compelled to fall back to a greater extent on the Ayrshire coal-field, in which, he estimates, more coal remains to be worked than in Lanarkshire. Fife and Midlothian are also likely to be much more productive in the near future. In Fife numerous deep bores are being made with a view to the development of the deeper seams. In Midlothian production has been kept back, it seems, "by the very conservative policy" of certain landowners, but this policy, we are told, has now been reversed, and steps are being taken by means of which the output of the county should soon be doubled or trebled. As to the time within which all the remaining coal in Scotland will be worked out, Mr. Dron, like other calculators before him, has made estimates on the assumption of a continually increasing production till the coal has all been removed; but he adds the unquestionably just observation "that long before these dates are reached, the continued increase of the output will have received a check, and that just as the output has gradually increased, so also will it gradually diminish." There we may leave the matter, for we have no means of estimating either when this check is likely to take place, or at what rate the diminution will proceed once it has set in.

G. G. C.

ASIA.

India.

'Cities of India.' By G. W. Forrest, C.I.E. Westminster: Constable. 1903.

In a fascinating series of sketches of the historic cities of India, Mr. Forrest has skilfully woven together the descriptive and historical material at his disposal, the former acquired at first hand during his journeys from end to end of our vast dependency, the latter derived from his unrivalled knowledge both of the official records formerly under his care, and of the writings of early travellers and historians. He is successful in recalling the old-time atmosphere of the events of which he writes, and takes his readers back with equal ease to the days of the Hindu dynasties of Ahmedabad and Jeypore, the Mogul rulers of Delhi and Agra, the early English enterprises at Surat, Bombay, and Madras, the somewhat later episodes at Cuddalore and Calcutta, and the Mutiny drama at Lucknow and Cawnpore. An instructive feature is the attention bestowed on the influence which geographical position and environment has exercised on the rise and fortunes of the cities. The arrangement is more or less topographical, corresponding as far as may be with an imaginary tour through the length and breadth of the country, and the book should thus prove a useful companion to the traveller who visits the historic sites of the Indian Empire. It is abundantly provided with illustrations of the cities, their architectural wonders, and other objects of interest.

AFRICA.

British East Africa.

'With Macdonald in Uganda.' By Major Herbert H. Austin. London: Arnold. 1903.

Major Austin's narrative of his latest exploring journeys in South Africa, noticed a few months back in the *Journal*, has been quickly followed by a second volume, recounting the earlier events connected with Colonel Macdonald's expedition, in which, as is well known, Major Austin took a prominent part. The complicated history of the Sudanese mutiny—the greatest danger, perhaps, to which British influence in Eastern Central Africa has yet been exposed—has never yet been the subject of a full and connected narrative, and the present volume is therefore to be welcomed as giving, not only an account of the occurrences in which its author took part personally, but also (though in less detail) of the part played by the other members of the expedition and Protectorate officials, during those critical months. It may thus serve to remove various misconceptions which have been current respecting these events. It has also an interest from a more strictly geographical point of view, especially with regard to the explorations carried out by Colonel Macdonald and his coadjutors in the then little-known districts between Lake Rudolf and the Nile. Major Austin pays a warm tribute to his leader, to whose fertility of resource, great knowledge of the country, and personal influence with the Waganda, the final success of the operations was, he considers, entirely due.

African Minerals.

'Les Richesses Minérales de l'Afrique.' Par L. de Launay. Paris: Ch. Béranger. 1903.

This book is to be welcomed as the first serious attempt to deal with the mineral resources of Africa in a comprehensive and systematic manner. Its appearance is very opportune at a time when the air is full of projects, well or ill founded, for the exploitation of these resources, and it is particularly valuable from

the unbiased standpoint of the author—Professor at the 'École supérieure des Mines'—who treats of the questions under consideration from the point of view of sober science, and is fully conscious of the reserve with which current statements as to African mineral wealth must be received. From a practical point of view, the book supplies a useful summary of our present knowledge respecting African minerals, each of which, from gold to coal and petroleum, is dealt with in turn, while the final chapters discuss the various regions in Africa from the point of view of the collective mineral deposits. The book has, however, a further, more theoretical, interest. The author has previously, in various writings, put forward his views as to the importance of the notion of *depth* in dealing with metalliferous deposits, and he now uses the facts observable in Africa as object lessons, illustrating the principles which he considers involved. He holds that the variation in the character of mineral veins according to the depth below the surface is of two distinct kinds, which have hitherto been too much confused. In the first place, there are differences due to the variations of temperature, pressure, etc., at different depths at the time of the original formation of the veins; and in the second, subsequent metamorphism will have operated in the neighbourhood of the surface, which will then be, in the majority of cases, totally different from the original surface which existed at the time when the veins were formed. It is generally impossible to study such variations as we proceed downwards in any one locality, but the writer points out that, as the amount of erosion has differed enormously in different areas, we can arrive at certain conclusions by comparing the character of the mineral deposits in two regions, in one of which a vastly greater amount of material has been removed from the surface than in the other. The African continent supplies an excellent field for such studies, by reason of the strong contrast displayed between the ancient mass which occupies its main bulk and the Tertiary zone of the north, while the subject has more than a theoretic interest, by reason of its obvious practical bearing. The introductory chapter contains also a useful general sketch of African geology as we now know it.

German South-West Africa.

'Deutsch-Südwest Afrika.' Von Prof. Dr. Karl Dove. Berlin: Süsserott. 1903.

This little handbook, which forms vol. v. of Süsserott's 'Kolonialbibliothek,' gives, for its size, the most lucid and systematic description of German South-West Africa that has yet appeared, the author being, both by his personal acquaintance with the country and by his careful study of the existing literature, particularly well qualified to write such a work. After a preliminary sketch of the history of the territory, Dr. Dove treats in turn of the broad physical features, the mineral resources, the climate, flora and fauna, and inhabitants, both native and European. In describing the surface features he divides the area into four natural regions, each of which has a distinct individuality. The first of these, the coast strip, though generally bare and arid, and showing but small variations of relief, differs considerably in its surface, sand being by no means universally present; it is, however, still but imperfectly known, especially in the south. The second, in the north and north-east (Ambo Land, etc.), is a remarkably uniform plateau with an average altitude of 3000 to 3300 feet, extending from the Kunene to the Okavango. This altitude is not great enough to admit of European settlement, but the district may serve for plantation purposes. The third region—Herero Land—the most important from the point of view of European enterprise, comprises three orographic subdivisions, the terrace lands of the north-west, the plains of the north-east, and the southern districts with the best-developed relief of the whole territory. The

fourth region is the more arid Nama Land in the south. From the point of view of vegetation, the coast strip is sharply contrasted with the other three regions. Dr. Dove considers that Swakopmund, in spite of the absence of shelter, is a far more valuable position than Walfish bay, owing to the much greater facilities it presents for penetration into the interior.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Volcanic Studies.

'Volcanic Studies in Many Lands.' By Tempest Anderson, M.D., B.SC., F.G.S., etc. London: John Murray. 1903.

The special feature of this book is the number and excellence of its photographic illustrations. Dr. Tempest Anderson has been for many years a well-known student of volcanic phenomena, and in the course of his visits to the active and extinct volcanoes of Europe and North America, has formed a large collection of photographic views illustrative of this branch of geological research. Many of the most interesting of these are included in this work, by the publication of which the author has made a valuable contribution to the literature of vulcanology. A word of praise is due also to Mr. Murray for the admirable manner in which the volume is got up.

For scientific purposes, a well-taken photograph excels all other kinds of illustration in truthfulness and accuracy; and the study of land-forms lends itself especially to this method of elucidation. The stay-at-home geologist, who examines carefully the plates contained in this book, cannot fail to obtain clearer ideas of the actual appearance of active volcanoes, and of the stages of their growth and decay. The author has not entered into the consideration of the more recondite and theoretical questions involved in the study of volcanic action, but has contented himself with depicting and explaining the principal types of volcanic structures. He furnishes, in fact, a series of object lessons, beautifully clear and often very striking, of the scenery of volcanoes, with explanations of the manner in which the topographic features have been produced.

The familiar landscapes of Vesuvius, Auvergne, the north of Ireland, and the Inner Hebrides are represented by a number of carefully selected examples, but the Icelandic views, which were obtained during two visits to that island, possess more novelty and interest to the geologist and geographer. The enormous lava-fields, studded with little cones, are shown in the photographs, and several beautiful plates are given of the row of craters which stands upon the Skaptar fissure. Many of the great lava-streams are cut by fissures of another sort, due to the escape of the still liquid interior at a time when the surface of the mass had already solidified. The unsupported crust has then subsided along great rectilinear cracks, leaving cliffs many feet in height, which often show a striated face owing to the friction to which it was subjected as the broken mass sank to a lower level. The most celebrated instance of this is the Almannagjá, where the deep valley of the Oxerà had been filled with a gigantic *coulée* of lava, and after the surface had cooled the deeper part of the lava-flow escaped. The crust collapsed, unable to support its own weight. and left a vertical wall over 100 feet in height, separated by a chasm from the remainder of the consolidated surface with which it had at one time been continuous. One of these outflow tunnels is shown in Plate LXXII. from the neighbourhood of Lake Myvatn, and in this case the stream of molten rock entered the lake, and, on coming in contact with the water, gave rise to steam explosions, which covered the surface of the lava with small secondary craters and spiracles.

Some of the most successful views given in the book are from the remote crater-lake of Oregon, and there are beautiful illustrations of the geysers of the

Yellowstone Park and the basalts of the Snake river, Idaho. The volume is thoroughly up to date, as it concludes with a few photographs of scenes in St. Vincent, West Indies, taken by Dr. Tempest Anderson during last summer, and a fine picture of Montagne Pelée in full eruption on the afternoon of July 9, 1902.

J. S. F.

GILBERT'S 'DE MAGNETE.'

William Gilbert, of Colchester, Physician of London. 'On the Magnet . . . a new Physiology.' London, 1900. Notes on the 'De Magnete' of Dr. William Gilbert. London: Privately printed. 1901.

The first of these volumes is a new and careful translation of Gilbert's famous work on the magnet, published under the auspices of the Gilbert club. The translation follows, page for page, the original Latin edition of 1600, the general style of the latter being also retained as far as possible. It is printed at the Chiswick Press, and the whole "get-up" of the volume is most tasteful. The volume of explanatory notes, got together mainly through the energy and zeal of Prof. Silvanus Thompson, is a most valuable addition to the text, and bears witness to an extraordinary amount of research and an unusually extensive acquaintance with the literature both of Gilbert's time and the century preceding it. The allusions and references in the text are elucidated with great thoroughness, and though the greater part of the notes naturally have to do with questions of magnetic theory, there are various points of more strictly geographical interest on which much light is thrown. Thus the history of the so-called "loadstone-rock" in literature and cartography is fully dealt with, reference being made to the legends in Ruysch's map, the supposed northern voyage of Nicholas de Linna as mentioned by Hakluyt, and to Peter Plancius' location of the rock on his lost map described by Blundeville. References are given to the extensive literature on amber and the amber industry, and there are useful notes on various points connected with the compass and its use, the history of "wind-roses," and the various designations of the points of the compass. The term for the north-west used by Gilbert—Borrholybicus—is rarely met with, though one or two authorities for its use are cited. To these might be added a couple of still earlier instances, viz. the chart of the coast of Sweden from Waghenaer's 'Speculum Nauticum' of 1585, which is reproduced by Nordenskiöld in his 'Periplus,' and the treatise on the winds by Fabritius Paduanius (1601). The name is also given by Coronelli in his 'Epitome Cosmografica' of 1693 as the Græco-Latin term for the north-west wind.

PRACTICAL ASTRONOMY.

'Grundzüge der Astronomisch-geographischen Ortsbestimmung auf Forschungsreisen und die Entwickelung der hierfür Massgebenden mathematish-geometrischen Begriffe.' Von Prof. Dr. Paul Güssfeldt. Mit 95 eingedruckten Abbildungen. Braunschweig: Druck und Verlag von Friedrich Vieweg und Sohn. 1902.

There are few men whose training and experience would render them better fitted to deal with the subject of practical astronomy for travellers than Prof. Paul Güssfeldt. His name has for years past been held in high esteem as that of a traveller and explorer of exceptional ability. His surveys in the Andes, West Africa, and elsewhere possess a scientific value and precision far in excess of those of the ordinary explorer, whilst his long experience as a university lecturer on mathematics has given him an insight into the methods of instruction most suitable to the requirements of the student who is likely to become a geographical surveyor. The work which he has recently published is, therefore, worthy of special attention, and will doubtless be read with interest by many.

It will at once be seen that it differs considerably in design and arrangement

from most others dealing with the same subject, which, however useful and important they may be in their place as text-books, giving formulæ and examples of computations, are often unsuited for purposes of instruction from the fact that they assume too much knowledge on the part of the student, and fail to give satisfactory explanations of the development of the formulæ employed. Prof. Güssfeldt, in his 'Grundzüge,' begins at the beginning, and from treating of the simplest relations that exist between numbers and quantities has endeavoured to follow up the mathematical investigations upon which the subject of practical astronomy is based step by step until he arrives at the conclusions sought and the rules and formulæ employed in fixing positions by astronomical observations. The book, in fact, treats the whole subject as connected and complete, and gives an outline of its development and growth from its foundations in elementary mathematics and geometry to its more complex computations and deductions. As its title indicates, it does not attempt to give anything more than an outline of the subject, and as the ground covered is decidedly large, it is not surprising to find that some matters appear to be too summarily dismissed. More than half of the book is taken up with preliminary matter, and this has rendered it necessary for the author to condense the latter and practical part, which after all is what the surveyor would find more useful. The actual fixing of positions by astronomical observations only forms one part of the duties of a properly qualified surveyor in little-known regions, and Prof. Güssfeldt would have added considerably to the value of his book if he had dealt also with triangulation, and topographic methods best suited to travellers, which, since the days of the pioneer explorer are almost over, are of ever-increasing importance.

The work is divided into twelve general sections, in each of which a definite branch of the subject is dealt with. The first is an introductory section treating of the elements of mathematics, logarithms, etc.; the second deals with geometry and plane trigonometry; the third with the foundations and facts of practical astronomy, such as the figure of the earth, axis of rotation, circles of the heavens, parallax, spherical co-ordinates, etc.; the fourth with time and time measurements; and the fifth with spherical trigonometry. After these follow sections six to twelve, which deal with the practical side of the subject, and show the application of the information imparted in the previous section to the various formulæ employed in fixing positions, adjustments of instruments, etc.

Although treating of the elements of the subject, in many respects Prof. Güssfeldt's book is far from an elementary work, yet it could not in any sense be considered to supersede the exhaustive and excellent treatises on Practical Astronomy that already exist, for there are many matters that are not dealt with at all in these pages; nevertheless, according to the author's avowed design and purpose, it deserves to occupy an important place as a good introduction to the whole subject, and as such it will doubtless be found useful by many. In future editions it would be well if some of the chapters could be amplified, and if its scope could be extended to render it better suited to the present requirements of the surveyor in imperfectly known regions.

CARTOGRAPHY.

French Military Surveyors.

'Les Ingénieurs Géographes Militaires, 1624–1831.' Étude Historique, par Le Colonel Berthaut, Chef de la Section de Cartographie. Paris, 1902. Imprimerie du Service Géographique.

This book is a sister work to that previously published by the same author, 'La Carte de France.' The earlier issue dealt with the history of map-making in

France; the present one is devoted to the study of the origin, the fortunes, the performances, and the eventual disappearance of the remarkable body of men to whom the maps of France and her colonies are due. The author has drawn the information contained in his two large volumes from the archives of the Dépot de la Guerre, from which source also are taken the numerous specimens of maps and plans with which they are illustrated. Colonel Berthaut's authority for all he relates is, therefore, unimpeachable.

The book, as pointed out by General Bassot, the director of the Geographical Department, in a preface which he contributes, is not one to be taken up and read through from end to end. It is rather a collection of important and interesting historical records, and is mainly useful as a work of reference, to the value of which the full table of contents and alphabetical index largely contribute.

The first attempts at detailed topographical surveying date from the seventeenth century. The pioneers of map-making were Gustavus Vasa in Sweden, Radziwill in Poland, Scheuchzer in Switzerland, Apian in Bavaria, Vischer in Austria, Muller in Hungary, Borgonia and Chaffrion in Italy. In France, Jean Leclerc, in 1640, presented to Louis XIII. a map of the country in nine sheets, engraved on wood.

Military topography at this early date was confined to the production of sketches not to scale, with heights shown in false perspective. The examples, however, of the style by Beaulieu and Sebastian Leclerc, which the author gives, are decidedly graphic, and, in their way, works of art.

The origin of the corps of *Ingénieurs Géographes* is the same as that of other branches of the engineers. During the first half of the seventeenth century, officers of special qualifications were taken from the infantry, and were employed on engineer work as *Ingénieurs aux fortifications*, *Ingénieurs des camps et des armées*, *Ingénieurs ordinaires du Roi*, *Ingénieurs géographes*. Beaulieu in 1639 was described as *Ingénieur et Géographe ordinaire du Roi*, and was probably the first to bear the title.

From the institution of the corps until the year 1809 the *Ingénieurs Géographes*, though charged with duties of the highest importance, and exposed to more than the ordinary risks of military service, had not the status of combatant officers, and were debarred from the prospects of promotion, and the rewards which fell to their less-deserving comrades. In time of war they were called upon to execute reconnaissances in front of the army of districts as little known as Central Africa is to-day; to provide sketches of the projected line of advance; and to furnish all military information of the routes. They had also to make plans of battlefields, sometimes before the opposing forces had closed, sometimes after the battle had been fought. In peace time they were engaged in surveying tracts of country, in sketching routes, and in compiling information concerning districts where operations were probable at some future date. In fact, they acted as an intelligence department, though dealing mainly with topographical matters.

The author divides his retrospect into eight periods, the first four ranging from 1624 to 1715, from 1715 to 1756, from 1756 to 1777, and from 1777 to 1791, and the last four covering the Revolution, the Consulate, the Empire, and the Restoration.

It is interesting to learn that, so early as the middle of the eighteenth century, the *Ingenieurs Géographes* did much valuable work in the French colonies and in foreign lands. They produced maps of Pondicherry, Trichinopoly, of the boundaries of Canada, Rio de Janeiro, French Guiana, Guadaloupe, Martinique, St. Lucia, St. Domingo, Surinam, and other places. A century and a half later Great Britain has not decided that such a work with regard to her own transmarine possessions is worth the expense involved.

Napoleon attached the greatest importance to the work of the *Ingénieurs Géographes*, though his references to that body, quoted by the author, are couched in terms neither complimentary nor appreciative. The Great Master of War, to whom time was always a matter of the first consideration, had little patience for the delays incident on the production of an original sketch, and still less for those due to the processes of reproduction. But Napoleon himself was one of the principal difficulties with which the corps had to contend. The author relates that, during the campaign of 1813 in Silesia, a waggon containing maps having been lost, it became necessary to send to Paris by special express for all available topographical information. The only map in the possession of the department, of which a rough tracing for the engraver had been taken, was sent, and Napoleon, once in possession of it, refused to give it up, although, without it, it was impossible to proceed with the engraving. After it had been in his hands a month, the chief of the Topographical Department ventured to ask for it; but before he had uttered two words, Napoleon stopped him with "*Vous raisonnez comme un Ingénieur Géographe vous! J'ai besoin de tout, e plus même, s'il y en a.*"

Napoleon, however, was the first to grant military rank to the corps, in 1809, and he decreed about the same time that it was in future to be recruited exclusively from the École Polytechnique.

Amongst the most important topographical results of Napoleon's time was the map of Egypt, on a scale of $\frac{1}{100000}$ in forty-seven sheets, which is to this day a standard work. It was compiled during the Consulate from sketches made by the French troops during the occupation of Egypt, and from all available documents both ancient and modern. The engraving was completed in 1808; but Napoleon then directed that it should remain a State secret document. In 1814 it was decided to publish the map, but it did not come into the hands of the public till 1820.

In 1831 the corps of *Ingénieurs Géographes* ceased to exist. Its members were incorporated into the General Staff of the army, and under another title their work is continued at the present time. Colonel Berthaut is not in favour of the reconstitution of a special corps of topographers on several grounds, but mainly because, in the interests of the education of officers in general, it is better that the study of topography should be encouraged amongst all ranks than that it should be restricted to a selected body. Whilst agreeing in this view, it is difficult to avoid the conclusion that the institution of the *Ingénieurs Géographes* in France has had much to do with the leading position she has taken in matters of topography, and with the example she has offered to other nations by giving to the world maps of all countries in which her soldiers have served.

J. K. T.

A Cartographic Annual.

'L'Année Cartographique. Supplément annuel à toutes les publications de Géographie et de Cartographie.' Dressé et rédigé sous la direction de F. Schrader. Douzième supplément contenant les modifications géographiques et politiques des années 1900–1901. Paris: Hachette et Cie. 1903. *Price* 3 *fr.*

This useful publication has now reached its twelfth year of issue, and in the present number the principal geographical explorations during the years 1900–1901 are dealt with. There are three sheets of maps, one devoted to Asia, another to Africa, and the third to America. Upon the first there are four maps and an inset showing the route and surveys of the Kozloff expedition through Mongolia and Tibet, those of Mr. R. Logan-Jack in Szechuan and Yunnan, and of Mr. Barclay Parsons from Hankau to Canton. There is also a small map of the French railway under construction between Lao-Kai in Tonking to Yunnan. The second

sheet contains a general map of Africa, illustrating the progress of railway development in 1901, maps showing the routes of recent explorers in the region of the upper Nile and Southern Ethiopia, the route of Mr. P. H. Selby in North-East Rhodesia, the explorations of MM. Bos and Superville in the region of the upper Ubangi, and of M. Lesieur in the French Congo district. On the American sheet there are maps of Canada and the United States, showing the progress of the Government surveys; Honduras, from the surveys of Dr. K. Sapper; and a part of Eastern Bolivia, from the maps showing the explorations of Colonel J. M. Pando and Sir Martin Conway given in the *Geographical Journal*. It is interesting and satisfactory to note that no less than five of the maps contained in this issue have been taken from those published in the *Geographical Journal*, in addition to which there is other evidence of the fact that this Society's publication has been freely used.

Upon the back of each sheet is given a short description of the maps and an account of each of the explorations and surveys they illustrate. It is clear that M. Schrader has made good use of the very limited space at his disposal, and the leading geographical facts connected with the various journeys are mentioned. The remarkable error of about two degrees of latitude which exists in the original maps of the southern section of the Kozloff expedition is referred to, and other matters of an interesting and important character are dealt with. Altogether the present issue of the 'Annés Cartographique' will doubtless prove useful for general reference, and it is only to be regretted that it is not further extended and rendered more complete.

GENERAL.

Naturalist Travel.

'Aus don Wanderjahren eines Naturforschers.' Von Ernst Hartert Berlin, London, and the Hague. 1901-1902.

This is a readable volume, made up of sketches of travel, mostly in the tropics, undertaken in various years from 1885 onwards, for purposes of zoological collecting and research. In the year mentioned the well-known German explorer, Flegel, was organizing his last fatal expedition to the regions of the Niger and Benue on behalf of the German African Association, and Mr. Hartert, then a young zoologist eager to make acquaintance with the marvels of tropical nature, volunteered to accompany the party as collector of natural history specimens. Another volunteer was Dr. Staudinger, to whom and Mr. Hartert it eventually fell, owing to the illness of other members of the expedition, to carry through the most important part of its programme—the journey from the Benue overland to Kano and Sokoto, for the presentation to the Emirs of those cities of letters from the German Emperor. The account of this journey forms the first item in the present volume, and the most important from a geographical point of view. The Hausa countries were then much less known than at present, and as the route from Zaria to Sokoto was one which had never been traversed by a European, the results were of some importance. They have, of course, been long since made public, both in scientific papers and in the work of Dr. Staudinger published in 1889, but Mr. Hartert's observations on the country traversed, its natural history, people and prospects, are of interest at a time when so much attention is being directed to the countries in question. The main ornithological, botanical, and other scientific results of the journey are recorded in special chapters. Some of the collections have unfortunately been dispersed without being properly described, and so little is really known of the zoology of the Hausa countries that Mr. Hartert promises a rich harvest to any naturalist who may make use of the newly gained facilities for research in those regions. Other journeys described in the volume took the author to south-east

Asia (India, Sumatra, and Perak, described as a veritable naturalist's paradise), the West Indies, the Canary islands, and Morocco, and though these of course yielded no geographical novelties, the narrative is always interesting, and shows once more the advantages which a scientific training affords to a traveller, both as regards his own enjoyment and his power of supplying instruction to the public.

EARLY VOYAGES.

'An English Garner. Voyages and Travels mainly during the 16th and 17th Centuries' With an introduction by C. Raymond Beazley. Two vols. Westminster: Constable. 1903.

These volumes consist of a reprint of the early narratives of travel contained in the 'English Garner,' issued by Prof. Arber between 1877 and 1890. They were there interspersed among other early literature, but have now been placed in a separate section of their own, and their re-issue in this form will no doubt be welcome to such readers among the general public as may wish to gain a general knowledge of the work of early English travellers without referring to such bulky and expensive works as Hakluyt's Voyages or the publications of the Hakluyt Society. Mr. Beazley's introductions, which are judiciously concise and to the purpose, will be an assistance to a right comprehension of the individuality of the travellers, the circumstances under which the journeys were made, and their contribution to the extension of knowledge. The greater part of the narratives are from Hakluyt (*e.g.* those of the Hawkins' voyages, Thomas Stevens' voyage to India, Cavendish's voyage round the world, etc.), but a condensed version of Linschoten, Wright's 'Voyage of the Earl of Cumberland to the Azores,' Knox's 'Captivity in the Highlands of Ceylon,' and some others, are also included. The modernizing of the spelling is perhaps to be regretted as detracting somewhat from the old-time flavour afforded by the narratives in their original form. Due though it may be to a lamentable (?) want of education, the quaint spelling of the old writers helps the reader not a little to transport himself back into the atmosphere of former times, which is to many one of the chief charms of such old narratives.

THE MONTHLY RECORD.

EUROPE.

Changes on the Coast-line of Brittany.—Various phenomena on the west coast of Brittany have led some writers to conclude that a gradual sinking of the land has been, and still is, taking place on that coast. The main reasons for this belief have been (1) the recent separation from the mainland of the archipelago or small islands to the south-east of Ushant; (2) the existence of submerged forest at Treompan, Goulven, and other points along the north coast of Léon; (3) the occurrence of supposed megalithic monuments below high-water mark, together with the legends respecting the ancient destruction of certain towns, and the actual engulfment of Tréoultié-Penmarch about 1530. In a note contributed to the *Annales de Géographie* (January 15, 1903), Prof. C. Vallaux shows reasons for doubting the conclusions drawn from each of these lines of argument, holding that the observed facts can be quite well explained as the outcome of marine erosion and allied phenomena. He points out that the former plateau, of which Mo'ène and the other islets south-east of Ushant are the scanty remnants, was composed of the granites injected into the core of the primitive Léon anticlinal, which are particularly liable to degradation, as is to be seen in the "Grève de Goulven," where an

area of 20 square kilometres of a similar granite has been entirely reduced to sand. As regards the submerged forests, he quotes a description by the careful observer La Fruglaye (1811), as proving that the trees grew in a moist and spongy soil, hardly raised above sea-level; and maintains that an invasion of the sea could well be brought about in such cases by the erosion of a previously existing barrier or the landward displacement of a line of dunes. The same explanation would apply to the now partially submerged monoliths, so far as these are genuine, while many supposed monuments of the kind are really, it is held, the result of natural forces The legend respecting ancient cities (Ys, Tolente) are also discredited. The writer does not deny that occasional movements may have taken place, but he maintains that these were entirely local, and did not affect the whole area at the same time.

The Popovo Polje in Herzegovina.—Dr. F. Katzer gives in *Globus* (vol. 83, No. 12) an interesting account of the Popovo "poljo," which occupies the north-western end of a depression in the Karst region of Bosnia and Herzegovina, of which the total length is some 30 miles, the breadth varying between 1 and 5. The central portion of this depression is more elevated than the two ends, which are both occupied by poljes, but the whole is traversed by the Trebinjčica, which makes its exit from the limestone as a considerable stream at the upper end of the valley, and resumes its underground course at the lower end. In summer the polje is drained by this and other underground channels, and the fertile deposit left by the water is then cultivated; but in autumn and winter, when the channels are unable to carry off the excess of water fast enough, the polje is converted into a lake 130 feet deep in places. The area is liable to be flooded at any time of the year, and it has been known that cultivation has been impossible for several years together. Besides the channel by which the Trebinjčica makes its exit, the principal outlet for the water is the Doljašnica "ponor," but as its mouth is some 25 feet above the level of the nearest point of the Trebinjčica, the inundation reaches a certain point before it comes into play. Dr. Katzer discusses the mode of origin of the depression, which has all the characters of a transverse valley, and must originally have been drained by a sub-aerial stream. He concludes that the basin was cut off from connection with the sea by the elevation of the intervening anticline, with which the wearing down of the former river-bed could not keep pace. This must have taken place at the end of the Pliocene period, or even later.

Distribution of Population in Wallachia.—M. Emm. de Martonne has investigated the distribution of the people of this province, drawing his data chiefly from the results of the census of 1899 and the *Indicator al comunelor urbane și rurale.* His map, published in the bulletin of the Roumanian Geographical Society, is based on natural districts, and the towns are distinguished by various signs according to their populations. Bukarest, the capital, contains 282,071 inhabitants, and there are, besides, five towns of more than 40,000 inhabitants, six with more than 20,000, and fifteen with more than 10,000, the aggregate population of all these constituting about nineteen per cent. of the population of Wallachia. The province is, however, almost entirely agricultural, and the towns are rather huge villages with few continuous streets, and the inhabitants of the suburbs gain their living by agricultural pursuits. Therefore, in calculating the district populations, M. de Martonne has not entirely eliminated the towns, but has included a certain part of their population in the country population. For instance, the small towns of 6000 to 20,000 inhabitants are reckoned at 6000 each, while for the highest class of over 200,000, containing only one town, Bukarest, 20,000 is taken. As the Bukarest municipal area covers 55 sq. kiloms., the density on this basis is less than 400 to the square kilometre (941 to the square mile), or not

greater than that of some of the upland valleys. Thus reduced, the population of Wallachia is 2,061,020, and the density 39·5 (102 to the square mile), while the density with the whole population of the towns included is 50 (129·5 per square mile). There are in Wallachia two chief zones of high density, the one skirting the foot of the Carpathians, the other following the course of the Danube. The former is the region of the earliest settlements, is particularly fertile and well watered, and contains the mineral wealth of Roumania, salt and petroleum, while the Danube valley is not only a great commercial highway, but is also well supplied with water, which, on the diluvial terraces to the north, has to be drawn up from deep wells. In the upland zone the density is 142 to the square mile; in the Danube valley it is reduced by the marshes of Balta to only 75·4. The diluvial terrace has a fertile soil, but an insufficient water-supply; nevertheless the density of population reaches 102·6, about the average for Wallachia. The hilly region, with 43 per cent. of the total population in 30·7 per cent. of the area, has a density above the average, while in the mountains there are only 12·2 inhabitants to the square mile, closely concentrated in the valleys. In much the same condition are the low terraces of Baragan and Buzeu, where water is hard to obtain except in the valleys. One of the most densely peopled districts of Wallachia is the Prahova valley, with 19,000 inhabitants and a density of 961. It is the great centre of the petroleum industry, and since the Predeal railway has been opened, one of the most frequented international routes in the country. The Teleajna valley is almost as thickly peopled, owing to the immense fertility of its soil. M. de Martonne also shows the grouping of the population by a map based on the average population of the *cătun*, a subdivison of the Commune, in each region.

ASIA.

Explorations in Asia Minor.—Dr. Leonhard, of Breslau, has extended his investigations in Northern Asia Minor (*Geographical Journal*, February, 1900, p. 175) to the examination of the ancient tombs in the region. His results, published in the eightieth annual report of the *Schlesischen Gesellschaft für vaterländische Kultur*, under the title "Paphlagonische Denkmaler (Tumuli, Felsengräber, Befestigungen)," deal specially with tumuli and rock tombs, the two kinds of burial-places which distinguish two ancient civilizations found in Asia Minor. Tumuli occur only in the great plains. Ramsay, and later A. Koerte, found them in ancient Phrygia; Leonhard now shows that they exist in Paphlagonia, extending their range considerably to the north-east. According to Herodotus (v. 8), this mode of sepulture was in use amongst the Thracians on the western side of the Black sea: the body of a nobleman was buried or burnt, and a large tumulus heaped upon the spot. The custom was thus probably introduced into Asia Minor from Thrace, and is an importation. The rock tombs, on the other hand, are peculiar to the peninsula; they are only known elsewhere in Egypt, of the time of the middle kingdom. Their use may have been due originally to the large number of natural cavities occurring in the rocks of Asia Minor, especially the limestones and recent eruptive rocks. The rock tombs of Paphlagonia are probably the most ancient; they were first discovered by Hamilton in 1835, and worked out systematically by Hirschfeld. Leonhard regards them as remains of an independent development from Hittite practice, the relation of which to the ancient Babylonian civilization has recently been demonstrated by E. Chantre. Leonhard finds evidence of the Hittite style of the Paphlagonian tombs in two chambers discovered recently by himself, one at Salarköj, and the other at Suleimanköj. Both have the peculiarly appropriate positions, in harmony with their surroundings, characteristic of the Paphlagonian tombs. Although

the point is hardly geographical, it is interesting to note that Leonhard believes one of the pictures in the antechamber of the Kalekapu tomb to represent a unicorn; this would be the earliest record of the fabulous animal, which is chiefly found in the pictures of the Middle Ages and in English coats-of-arms. Nearly all known heraldic beasts occur in Hittite art, including the prototypes of the Russian and Austrian double eagle. The geographical nature of the country, with its steep forest-clad slopes to the Black sea, prevented the Greek colonies (Sinope) from extending their influence into the interior in pre-Alexandrian days; on the contrary, traces of Hittite civilization made their way through Phrygia to Greece, where the Mycenæan culture shows unmistakable signs of relationship to the older or contemporary culture of Asia Minor. The irruption of the Cimmerians seems to have marked the end of the development of culture in Paphlagonia and Cappadocia, hence the last Paphlagonian rock tombs are probably not older than 700 B.C.

Explorations in the Kashmir Himalayas.—One of the finest but least-known mountain groups in the Kashmir Himalayas is that of the Nun Kun, which culminates in the twin peaks of Ser and Mer, both nearly 23,500 feet high. This has lately been explored by Dr. A. Neve and the Rev. C. E. Barton, the former of whom describes the journey in the *Alpine Journal* for February of this year. The time occupied by the trip was only a month, including the route from and to Srinagar across several snow-passes, so that a thorough exploration of the district was impossible; nor was any attempt made on the peaks themselves, which have generally been put down as inaccessible by reason of their vast outlying precipices. Some additions were, however, made to our knowledge of the topography of the district. From Suru, where a set of sturdy Ladaki porters were taken on in place of the Kashmiris, the route led first east-south-east up the valley of the Suru river, and then south up that of its tributary the Shafat-chu to the foot of the great glacier which descends on the east of the Nun Kun. From the summit of the Pukartse La, on the spur which causes the Suru to make a wide sweep to the south, one of the grandest mountain views in the world is obtained, the more southern of the twin peaks standing out clearly by itself at the head of the great Ganri glacier, and presenting from this side a dome-shaped outline. In the Shafat valley it was found that the main glacier extends 2 or 3 miles lower down than it is marked on the Survey map—a fact which is not wholly to be explained by a recent advance, though of this there were some traces. The glacier was followed up to the snow-field between the two peaks, a night being spent at 15,000 feet, and 18,000 feet reached the next day, the last part of the route being up a great sloping ice-wall. Returning to Suru, the travellers made a fresh start in a southerly direction, in part along the bend of the Suru river, which here flows in a natural tunnel, covered in by fallen boulders. Ascending to the rocky ridge, called by the guide the Sentik La (16,500 feet), it was found that D 41 of the map is merely the west buttress of the great dome of the Nun Kun, which rises on this side from a snow-field nearly 19,000 feet above the sea. To the south and west the travellers looked, not, as might be supposed from the Survey map, down into the Wardwan valleys, but on to a vast snow-field, which runs down west from Nun Kun, and is in places 2 or 3 miles wide. Beyond this the Barmal La was crossed, and a descent made in safety, though with some difficulty in the case of the laden porters, into one of the deep Wardwan valleys, and so *viâ* the Mongil and Margan passes to the valley of Kashmir.

AFRICA.

The Semna Cataract of the Nile.—A careful study of the Nile rapids at Semna, between the second and third cataracts, has lately been made by Mr. J. Ball, of the Geological Survey of Egypt, with a view to throwing light on the

physical changes which have taken place within the historic period. The results are put forward in a paper published in the *Quarterly Journal* of the Geological Society for February 10, 1903 (vol. lix. part i.). It was first made known by the researches of Lepsius during his expedition of 1842–45, that the then high-water level of the Nile at Semna was about 24 feet lower than the level indicated by the sculptured marks on the rocks at Semna, and the problem presented by this fact was in 1850 suggested by Horner, a former president of the Geological Society, as an interesting subject for elucidation by any geologist who might visit the spot. No such investigation seems, however, to have been made until the visit of Mr. Ball last year. Above and below the site of the temple ruins at Semna and Kumna, the Nile has a breadth of about 1300 feet, but between the two temples a narrow band of hard red and grey gneiss forms a natural barrier across the stream. At high Nile the river flows over this barrier with but slight diminution of width, though with increased velocity and violent eddies. But at low Nile the gneiss band entirely bars the stream, except for a narrow central channel about 130 feet in width. The gneiss of the barrier is very hard, with well-marked foliation planes striking parallel to the direction of the river. The portion laid bare at low water is honeycombed with large pot-holes, which bear witness to the powerful grinding action of the stream in flood. No trace was found of the existence of a soft basic dyke such as accounts for most of the channels at Assuan, and Mr. Ball is of opinion that both the deep central channel and the smaller channels, filled only at high water, are due simply to the erosive action of the river, the flow of which coincides in direction with the strike of the foliation planes of the gneiss. He considers that the change of level above alluded to (which has taken place within a period of about 4200 years) can be quite well explained as a result of the wearing away of the barrier by erosion. The vertical extent of such erosion works out at about 2 millimetres per year, which corresponds to the removal of only 5 milligrammes of rock per ton of silt-laden water, and of this Mr. Ball thinks that at least two-thirds is accounted for by the pot-holing action. Similar studies at other points have thrown much light on the past changes in the course of the river: and from the deep soundings which have been found below the new dam at Assuan, it seems possible that the classical descriptions of the Assuan cataract as a distinct waterfall may have more foundation than has been supposed.

Surveys on the Upper Nile.—With reference to the surveys lately executed by Major Delmé Radcliffe in the Nile province of the Uganda Protectorate (*ante*, p. 162, and map), a correspondent points out that a survey of the Nile below its exit from the Albert Nyanza was carried out by General Gordon, when governor of the Egyptian Sudan, and that his original map was in the hands of a Belgian missionary not many years ago. Maps showing the results of Gordon's survey were published in vol. i. of the *Bulletin* of the Khedivial Geographical Society, and (on a reduced scale) in vol. xlvi. of the *Journal* of our Society, as well as in the *Geographical Magazine* for 1877. It is also pointed out in *Globus* (No. 14, 1903) that the surveys executed by Emin Pasha in the equatorial province, though not based on astronomical observations, agree on the whole well with those of Major Radcliffe, both as regards the positions of Dufile, Fatiko, and Fadibek, the altitudes, and the course of the Nile between Dufile and the Albert lake. In particular, the courses of the Ateppi, Unyame, and Eyuppe agree well in the two surveys.

Balloon Experiment in North Africa.—The French officer generally known by the *nom-de-plume* of Léo-Dex has for some years been attacking the problem of the possibility of crossing the Sahara in a balloon, and for the purpose of experiment, he, at the close of last year, with several coadjutors, went to Gabes with a view to launching a pilot balloon in the hopes that it might be taken by

the local wind currents into the region of the trade winds, and so be carried across the Sahara to Timbuktu (*Tour du Monde*, 1903, No. 12). This result was not attained, though the balloon made a journey of several hundred miles before coming to the ground in Southern Algeria. From the direction taken by it in its voyage, it appears that the wind, which often blows steadily in winter in the neighbourhood of Gabes for considerable periods, assumed an easterly direction above the sands of the great Erg, and, carrying the balloon westward in about 32°, finally veered still more and carried it northward to a point on the Wed Jedi, a little north of 31°, when it was brought to the ground by the Arabs by means of the guide-ropes. A similar attempt might in other circumstances meet with success, for, as the influence of the regular trade winds begins to be felt in this region in about 30°, the local currents would have to be maintained only some 2° further to the south in order to bring a balloon within the sphere of action of the trades.

Prof. Fischer's Explorations in Morocco.—Prof. Theobald Fischer's important researches in the Atlas Vorland of Morocco are completed by the account of his third journey in that region, published in the *Mitteilungen* of the Hamburg Geographical Society (vol. xviii.). The journey, which extended over some three and a half months, was made in the early part of 1901. Prof. Fischer was accompanied by Dr. Weisgerber, who had been in medical practice for four years in Casablanca, and was familiar with many aspects of the region traversed, and by Dr. G. Kampffmeyer, of the University of Marburg. The main objects of the expedition, which were for the most part successfully accomplished, were the examination of the fertile "black earth" region in the coast provinces Abda, Dukkala, and Schauia. Each province was crossed once from the coast to the interior and back. Another feature was the exploration of the unknown course of the Um-er-Rbia below Meshra-esch-Schaêr, where Prof. Fischer had to leave the river in 1899; this also has been substantially completed, although it was impossible to keep to the stream closely throughout, on account of the difficult nature of the country. As a type of the land-form found, the river-loop at Bu-el-Awân was minutely surveyed on a scale of 1 : 100,000 Bu-el-Awân is a ruined fortress, which has not hitherto been visited by a European, although in the end of the eighteenth century Dr. Lemprière saw it from a distance. In view of the important commercial relations existing between Hamburg and Morocco, Prof. Fischer devoted special attention to the trade possibilities of the country, making considerable stays in Mogador and Casablanca, and drawing a new plan of the former town on a scale of 1 : 10,000. The excursions into the interior also gave an opportunity of adding considerably to our knowledge of the provinces of Schedma and Ahmar. Schedma is a relatively poor province, of which Mogador is the capital. Ahmar belongs to the second step of the Atlas Vorland, rising steeply from the plain of Abda to a height of about 400 metres, and having the Zyma lake as its chief feature. Two minor objects of the expedition had to be abandoned, chiefly on account of political difficulties: the making of excavations in the slag-heaps and barrows at Aïn-el-Hadschar in Schedma, in order to determine the nationality of the former workers in iron, whom Prof. Fischer supposes to have been Phœnicians; and exploration of the Djebel Zerhun, a small mountain district between Miknâs and Fâs, inhabited by practically independent Berbers. Incidentally, an important result of the expedition is the establishment of meteorological observing stations at Casablanca and Marrakesch. We are only able to give the main outlines of Prof. Fischer's account of his arduous and sometimes dangerous work: it is scarcely necessary to add that his narrative abounds in accurate detail of all kinds—analyses of soils, determinations of heights, and the like.

The French Colonies of Guinea with Respect to Colonization.—Dr.

Barot describes (*La Géographie*, No. 1, 1903) the natural conditions of the West African colonies with the object of determining their adaptability for European colonization. The mountain system he describes as consisting of three ranges parallel to one another and following the outline of the coast. These are crossed in a direction from south-west to north-east by five lines of folding, which constitute watersheds, except the third, traversed by the rivers Comoe and N'Zi. The isothermic lines run parallel to the mountain ranges, but it is singular that the mean annual temperature decreases towards the equator. On the Senegal, where there is little rain—8 inches in the year—the east winds from the Sahara raise the temperature sometimes to 107° Fahr. South of lat. 40° the mountains turn aside these easterly winds and arrest the clouds, so that the annual rainfall rises suddenly to 24 inches. Below lat. 9° the rainfall is 52 inches, and on the coast plateau more than 78 inches. Here the temperature is modified by the dense clouds, but the atmosphere is saturated with moisture. The coastal zone is covered with tangled forest, whereas on the plateaus of the upper Niger, Volta, and Senegal the vegetation is luxuriant without being rank. Natural products, such as vegetable butter, indiarubber, palm-oil, kola-nuts, ground-nuts, etc., are mingled with European vegetables and American cereals. North of lat. 14° there are only steppes covered with scanty grass and stunted trees, or the sands of the Sahara. On the plateaus also are concentrated the greater number of the native inhabitants. During the last quarter of a century, however, they have been decimated by the wars and slave-raids of Samory, Babemba, and other chiefs, and the villages and towns have dwindled. Kong, which in 1887 excited the astonishment of Binger, now hardly exists. For Europeans these plateaus are as healthy as Algeria. During the doctor's service with two columns the mortality was only 15 per thousand, and the number of serious cases of disease only 80. The most favourable zone lies around the upper Niger and its affluents at an elevation of 650 to 1300 feet, and has an area of some 58,000 square miles. It is well watered and extremely fertile. Somewhat less desirable, because it slopes to the west or south, is the region watered by the upper waters of the Bakoi, Bandama, Komoe, Volta, and Weme, with an area of 154,000 square miles. A third zone, fairly good, is divided into two, and consists of French Guinea and Futa Jallon on the west, 13,500 square miles, and the basins of the upper Sassandra and of the middle Bandama, Comoe, and the Voltas, about 108,000 square miles. Together these three zones cover an area of about 333,000 square miles, of which 270,000 are in French territory.

French Surveys in the Lake Chad Region.—The surveys carried out in the region of Lake Chad by Colonel Destenave and officers under his orders have already been briefly referred to in the *Journal*, and fuller details have now been supplied in several publications, including the *Comptes Rendus* of the Academy of Sciences (1903, p. 575), *La Géographie* (March, 1603), and the *Revue Coloniale* (1902, p. 331). The surveys have dealt not only with the shores of the lake itself and its islands, which have now for the first time been delineated with any accuracy, but with the region of the Lower Shari and that to the east of the lake on either side of the Bahr-el-Ghazal depression. The islands are arranged in two main groups, the Kuri archipelago, occupying the great eastern bay, and that of Buduma, which fringes the coast of Kanem from 13° 30′ N. lat. They form an immense littoral system, the individual parts of which are disposed in a north-north-west direction, this being the resultant of the directions of the two prevailing winds in this region. The islands are generally low and composed of sands and clays deposited by the Harmattan or north-east wind. Some are inhabited, and rise in sandhills to a height of 35 to 50 feet above the water. Others are covered with pastures, and reach a height of 12 to 16 feet; while a third type

consists of low islands rising only 1 or 1½ foot above the lake. As is the rule with the lakes of sandy desert regions, Chad appears subject to a displacement in the direction of the dominant winds, a silting up being observable in the east and north-east, while the waters are extending towards the west and south-west—in which direction the greatest depths (about 40 feet) occur, those in the east reaching only 12 to 16 feet. Among the items of geographical work (in addition to the survey of the islands) accomplished by the officers under Colonel Destenave, some of the most important are: (1) The fixing of the geographical co-ordinates of various points, by Lieut. Huart, the latitudes being obtained by circum-meridian altitudes of stars, the longitudes by the transport of time in a closed circuit; (2) observations of the level of the lake near the mouth of the Shari, during the months of February to April, 1902 (the variations were found to be in direct relation with the direction and force of the winds, the maximum reaching 10½ inches (0·27 metre)); (3) the detailed examination of the south-east shore of the lake by Captain Dubois, with a study of the vicissitudes to which the Bahr-el-Ghazal has been subject, down to its abandonment by the lake waters. The valley of the Bahr-el-Ghazal and the country to the north of it have also been carefully studied by other officers. Various contributions to our knowledge of the hydrography of the Shari have also been made, while reconnaissances have been carried out both in Kanem and Wadai, those in the latter being of special interest by reason of the scantiness of our information respecting the geography of the country. Lake Fettri, or Fittri, was reached by Lieut. Avon, who places it in about 12° 40′ N., 17° 40′ E., or in very nearly the position it has hitherto occupied on our maps. Geological, biological, and ethnological observations have also been made, the geological specimens showing the abundance of eruptive rocks in the region explored. The Kuri and Buduma archipelagoes are estimated to contain, respectively, populations of 19,000 and 17,000 souls.

German Expeditions between the Benue and Lake Chad.—The expedition of Colonel Pavel, by which German authority was first established in the northern parts of the Kamerun territory, has been followed by others, which have added considerably to our knowledge of the country. Lieut. Dominik, who has traversed the region between the Benue and Lake Chad by various routes, gives, in the *Deutsches Kolonialblatt* (Nos. 5–7, 1903), a detailed account of the country, which is valuable as giving trustworthy information as to the present political situation in German Bornu, as well as of the relations of the various elements which compose its mixed population. He divides the region described into three main natural divisions: (1) Adamawa proper, including the river-areas of the Mayo Kobbe and Mayo Lue and the mountain massifs to the north; (2) the isolated mountain district of Mandara; and (3) the lowlands, which may be divided again into German Bornu and the Pagan districts extending east to the Shari. Adamawa, though properly a political division, corresponds also, he considers, with a natural division of the region. The fertile Benue valley is shut in on the north by a sandstone plateau, the river flowing in a bed some 800 yards wide, and offering no hindrance to navigation between July and September, though in October it falls rapidly, and at this time its tributary, the Faro, shows in places no water at all above its sandy bed. The two main caravan routes to the north run one on each side of the Tengelin massif, which stretches north of Garua, and is inhabited by the Pagan Falli stock. Lieut. Dominik traversed the northern lowlands by three different routes, the two western leading to Dikwa, the capital of German Bornu, the easternmost to Lake Chad by the lower Logone. The shores of the lake are more or less swampy throughout a zone of some miles, the passage from firm ground to the open water being very gradual. Clouds constantly hang over the

water, being caused by the desert sand from the north, which gives rise to a succession of sand-dunes traversing the black-earth plain to the south. Between the lake and Dikwa village follows village very closely. The land is fertile, and the Kanuri especially live well, great plenty prevailing in Dikwa. The writer considers that, owing to its central position, Bornu must always maintain its importance as the meeting-ground of Mohammedans from the north, south, east, and west. Further south, on the headwaters of the Benue, some entirely new ground has been broken by the expedition despatched by the "Niger-Benue-Lake Chad Committee" (*D. Kolonialzeitung*, No. 13). At Rei Ruba, the capital of Bubanjidda, where the first German Kamerun expedition met with a check from the hostility of the king, the expedition was accorded a particularly friendly reception. The town is surrounded by a wall and ditch, and the Fulbe of Bubanjidda are as warlike as any in German Adamawa. Hence the hitherto unknown tract extending to the French frontier was explored, and was found to consist of a mountainous country cut up by streams which flow to the Mao Shuffi, an important tributary of the upper Benue not marked on existing maps. The geological formation is principally granite. The route was continued south to Ngaundere, whence the expedition returned to Garua.

AMERICA.

The Level of the Great Salt Lake.—The progressive fall in the level of the Great Salt lake continues to attract attention, fears being expressed in some quarters that if the shrinkage is maintained much longer, the lake may dry up entirely. Among writers who have discussed the cause of the fall in the level is Mr. L. H. Murdoch, of the U.S. Weather Bureau, who sums up his conclusions in the *National Geographic Magazine* for February last, having entered more fully into the meteorological factors involved in the *Monthly Weather Review* for October, 1902. The fall in the lake-level has been particularly rapid during the last three years, the deficiency of precipitation having also been most marked during the same period, though the present dry cycle has lasted since 1887. On December 1 last, the reading of the gauge at Garfield beach was 5 feet 11 inches below the zero of the scale, showing a fall of 11 feet 7 inches since the close of 1886, the year in which the last rise terminated, and a level between 3 and 4 feet below that of 1847. The last wet cycle lasted from 1865 to 1886, during which the lake rose to about 13 feet above the zero mark (in 1868 and again in 1876). The annual precipitation averaged 18·42 inches, or 1·77 above the normal, during this period; while for the years 1887-1902 the average has been 14·8 inches, or 1·85 inch below the normal. Mr. Murdoch considers that even were this low rainfall to be maintained, the level would not fall without limit, but that a balance would in time be reached between the area of the lake and its inflow, and the decline would then terminate. The large deficiency of 29·6 inches in precipitation during the last sixteen years seems certainly the main cause of the fall of the lake, for the possible loss fron irrigating 609 square miles of land must be very small by comparison.

The Eruption of Santa Maria in Guatemala.—Dr. Sapper arrived in Guatemala on the day on which the eruptions commenced, and immediately hastened to the seat of devastation. The area over which more than 20 cm. (nearly 8 inches) of ashes and pumicestone have fallen extends to about 2000 square miles, and within it most of the houses and farm buildings have fallen in under the weight of the ejectamenta, and in some places are totally destroyed. Several hundred persons must have been killed. The damage done to crops is enormous, especially in the coffee districts of Xolhuitz and Costa Cuca. Many plantations have been definitely abandoned, and many others cannot probably be restored.—*Zeitschrift der Gesell. für Erdkunde zu Berlin*, No. 1, 1903.

The Caura Territory in Venezuelan Guiana.—In the winter of 1901-02 Dr. Passarge visited the country between the Caura and Cuchivero rivers, examining a region 2500 square miles in area. On the way to the Caura the longitude of Bolivar was ascertained to be 63° 39′ 13″ W., or only 2¼′ less than on Sievers' map. The longitude of Alta Gracia, however, 63° 37′ 15″, differs by ¼° from Humboldt's survey, on which all the present maps are based, and therefore the whole basin of the upper Orinoco should be displaced ¼° to the east. The Caura river has a breadth of 1200 yards at its mouth, and of 650 to 850 further up. The Cuchivero issues from the Guiana mountains at the Raudal Alto, and expands from a breadth of 65–100 yards to 160–220. Below Las Lajitas there are no obstacles to navigation, and small steamers can ascend the river in the rainy season. The Sipao, a tributary of the Caura, and the Tucuragua are also navigable by canoes. The southern limit of the district explored is formed by the gneissic plateau of the Guiana highlands, which northwards sinks down below the level of the Llanos. Isolated groups of hills, almost entirely composed of granitic rocks, intervene between the Guiana highlands and the Llanos steppes, which extend from the cordillera of northern Venezuela across the Orinoco. These Llanos do not pass imperceptibly into the delta of the Orinoco, but 14 to 18 miles west of Las Castillas end in a steep edge 160 to 260 feet high. Dr. Passarge was struck with the resemblance of the surface forms of the archæan mountains with that of many South African ranges. The laterite of the Llanos is of ancient origin, as is also the African laterite, and this fact suggests that there may have been a great period of laterite formation. Another interesting question is whether the Llanos are a salt or fresh-water deposit. The strata, of enormous depth at the foot of the cordillera, thin out towards the Guiana highlands, where they do not reach a thickness of 65 feet. The material, then, came chiefly from the former elevation. Was the latter a bare rocky region where little detritus was produced, or were transporting agents wanting? In connection with this question stands the circumstance that the Orinoco has moved sidewards to the Guiana mountains, and now lies between them and the Llanos. Its bed is cut in the Guiana rock, but in the plain of the Llanos, the bed-rock being observable in most parts of its course. As regards the steep edge of the Llanos plateau in the delta, it may be asked whether it is of tectonic origin or caused by erosion, and whether a negative displacement of the shore-line has assisted in its formation.—*Zeitschrift der Gesell. fur Erdkunde zu Berlin*, No. 1, 1903.

The Temperature and Rainfall of the Argentine Republic.—Dr. Josef Chavanne has published a sketch of the meteorology of the Republic in the *Veroffentlichungen der D. Akad. Vereinigung zu Buenos Aires*, Bd. i. Heft vii. The temperature means are derived from observations during forty-five years, 1856-1900, and the rainfall from a period of forty years, 1861-1900. He divides the country into five climatic regions, of which three are subdivided into two sections each. The eastern region, lying between the Uruguay and Parana, and extending down to Viedma, is characterized by greater warmth in autumn than in spring, the maximum difference being 1°·6 Fahr. The chief cause of this phenomenon is the alternating influence of the warm Brazilian and cold Falkland currents. West of the coast region, the country from the forests of the Chaco in the north, and including the greater part of the pampas, is more than 4°·5 warmer in spring than in autumn, and has a greater annual range of temperature—maximum 29°. The region between the sierras of Aconquija and Ancasti and the outer ranges of the eastern cordillera, rising from 650 to more than 5900 feet above sea-level, consists largely of salt-pans and sand-dunes, where in January and February daily means of 88° are recorded and absolute extremes of 110° are not uncommon, while in July

the daily mean up to 2600 feet often falls nearly to freezing-point. A peculiarity of this region are the hot local winds called *zondas*, caused by the configuration of the country and the nature of the soil, which blow with great frequency and regularity in the summer months, and sometimes raise the temperature as much as 18° to 34°, and reduce the relative humidity to zero. The annual range of temperature reaches up to 29°, and the temperature of spring exceeds that of autumn by more than 4½°. The rainfall varies from 8 to 16 inches. At heights of 3000 to 3900 feet the climate is very beneficial to health. The northern Andine region has a small rainfall of less than 8 inches, 90 to 98 per cent. of which fall between October and April. The range of temperature is less than in the steppes and central zone, while the excess of heat in spring over the autumn temperature here reaches a maximum. The southern Andine region is marked by the occurrence of winter rains, an increase in the annual fall, a greater range of temperature, and relatively cold winters. The southern extremity of the republic is divided into the east and west Patagonian regions. Owing to the smaller breadth of the continent, the difference of temperature between the east and west coast is small, but there is still a difference of 1° to 3½° in favour of the former. The rainfall shows much greater variations. Whereas from the mouth of the Chubut to south of the Straits of Magellan it is under 10 inches, it is fully 16 inches on the Pacific coastal strip, and rises to as much as 31 inches in some valleys and lake-basins east of the Andes. A long series of observations has been made only in the Valle 16 de Octubre, where the range of temperature is 90·9° (max. in December and January, 95°; min. in July, 4°·1). In all seasons of the year, winds from the western quadrant predominate and penetrate to the plateaus of the east coast, bringing rain with them, while the east and north-east winds are dry. Staaten island, with its large rainfall and great humidity, belongs to the west Patagonian region, and exhibits to a marked degree the oceanic type. As a whole, the Argentine climate is intermediate between the sea and continental types, a purely continental climate not existing even in the steppe region.

POLAR REGIONS.

Antarctic Expeditions.—The destination of the expedition which was being organized by Dr. Charcot for research in the arctic regions has suddenly been changed in view of the interest aroused in the South Polar region by the various expeditions now at work in that quarter. It had been from the first hoped that the proposed arctic voyage might lead the way to a more important venture in the antarctic, and it has now been decided to abandon the original plan and substitute that of a voyage to the south. This will, of course, retard the date of departure somewhat, besides rendering it necessary to collect more funds, but it is hoped that the delay will not exceed a few weeks. The *Tour du Monde* (No. 19, 1903) prints the memorandum adopted by the committee to which the organization of the expedition has been entrusted, from which it appears that the scene of action will be Alexander land, south of Graham land, and that, besides researches in oceanography and the various branches of zoology, it is hoped to carry out more strictly geographical work, including explorations on the southern continent. It does not seem to be contemplated to spend a winter in the antarctic. With regard to the Swedish expedition, of the return of which news had before this been expected, the despatch of a relief expedition has been determined on, and the necessary funds have been voted by the Swedish Parliament.

The German Station on Kerguelen Island.—The observers left on Kerguelen island by the German Antarctic Expedition for the purpose of carrying out

observations of terrestrial magnetism, etc., simultaneously with those of the main expedition, have returned to Sydney, with the exception of Dr. Enzensperger, who, we regret to say, succumbed to beri-beri during the stay on the island. The party appear to have had a very trying time, and another of the staff, Dr. Werth, was also ill on arrival in Sydney. Hopes are, however, entertained of his recovery.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Subterranean Waters.—Dr. F. J. Fischer has collected in the *Abhand. der K.K. Geogr. Gesells. in Wien*, No. 5, 1902, a large number of examples of the interaction of sea and ground waters. About a third of the rain that falls on the land filters downwards or trickles through fissures until it reaches impermeable strata, over which it spreads, forming reservoirs for the supply of springs and underground rivers. In some cases these reservoirs are connected with the sea, and the pressure of the salt water holds up the water in the underground channels to a height above the sea-level corresponding to the lower specific gravity of fresh water. When, however, the upper level of the fresh water is raised equilibrium is disturbed, and fresh-water springs rise up near the shore. Such are found in all parts of the world. One, particularly described by Dr. Fischer, is the Polla di Cadimare, in the gulf of Spezia, which shoots up to a height of 60 feet from the sea bottom and forms a small hillock on the surface. The water that feeds it falls as rain on the Apennines 3 miles distant. The magnitude of the complicated systems of subterranean channels is a proof, in Mr. Martel's opinion, of a diminished supply of water on the surface, for such extensive erosion must have been the work of much greater volumes of water than flow over the land at the present time. Erosion is still at work, though on a lesser scale, and in many Karst lands the water-supply is becoming a serious difficulty. In Yucatan most of the inhabitants have to obtain water from cave springs 1000 feet below the surface. A curious case of sea-water penetrating into the land may be observed at the Argostoli peninsula, in the island of Cephalonia. Here more than 2,000,000 cubic feet of water disappear through the fissures of the rock, and it has been proved that this salt water lies at a level of 5 feet below the surface of the sea. What ultimately becomes of it has not yet been ascertained. It may be raised by lateral pressure and sucked up through narrow channels, more or less vertical, into underground streams of fresh water and reappear in the brackish springs of the island. But the discharge of these springs is quite out of proportion to the sea-water absorbed, most of which, therefore, must be carried underground to far distant points. Elsewhere, also, brackish springs are formed by suction, and break forth at no great height above sea-level. Another interaction of salt and fresh water is due to the tides. At high tide the sea-water dams up the fresh water in the subterranean channels, and thus causes it to rise in wells and springs. Generally such wells afford a larger supply of water at high than at ebb tide, but in some the reverse is the case. Thus a boring at Fulham, 318 feet deep, yields during flood tide 60 gallons of water, and during the ebb 80 gallons. Probably the pressure of the tide is transmitted to branches of the underground water-system at a considerable distance from the outlets to the river, and therefore the effect of the pressure does not manifest itself at the boring till long after high tide. Similarly in impermeable ground rain floods the country at once, whereas in Karst lands it runs underground, and reappears to flood the country after a considerable lapse of time.

OBITUARY.

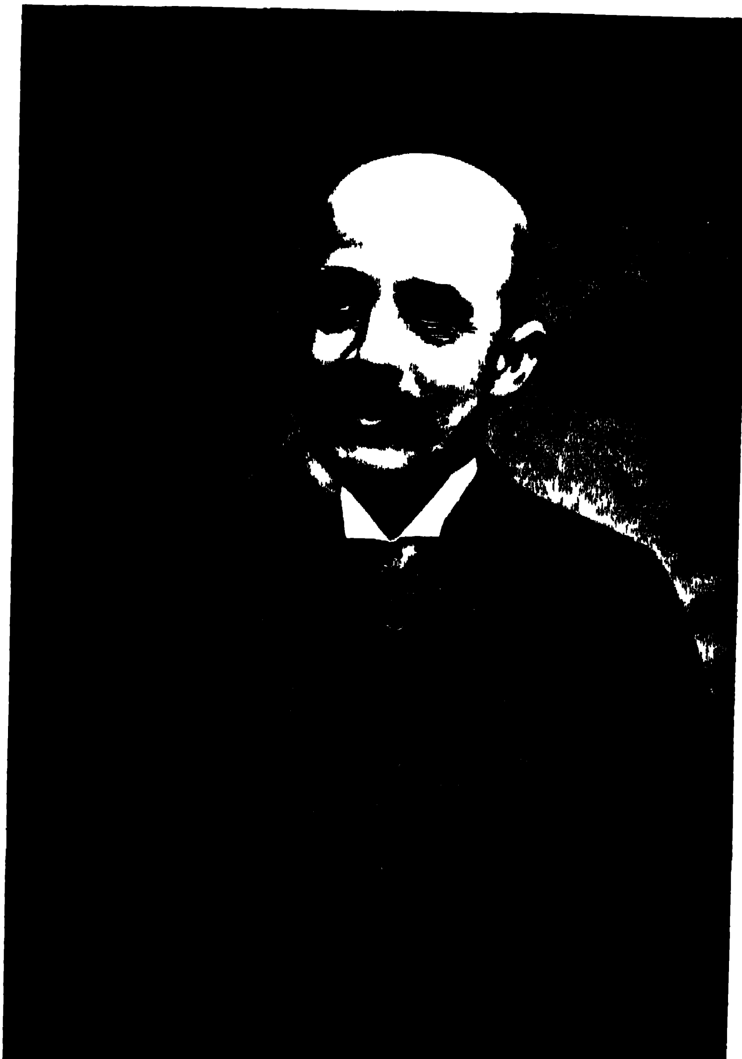
Paul Belloni du Chaillu.

P. B. Du Chaillu, the distinguished African explorer, died at St. Petersburg on April 29. He was born in France* on July 31, 1835. His father having been appointed agent of Messrs. Oppenheim, of Paris, at the Gabon, where the French had built a fort in 1812, he accompanied him thither when still a boy. Such education as he received he owed to the missionaries established at the Gabon. But if facilities for a systematic course of instruction were wholly lacking in that out-of-the-way place, young Du Chaillu gained a thorough knowledge of native customs, acquired the language of the country, and became an expert sportsman, all of which proved of great service to him in his career. In 1852 he went to the United States with a natural history collection, the spoils of his gun, and, having attracted attention by a series of articles in the New York *Tribune*, he was entrusted by the Academy of Natural Sciences of Philadelphia with a mission to Western Africa.

He set out from New York in October, 1855, reached the Gabon in December, and up to June, 1859, carried on explorations which not only yielded rich and valuable zoological collections, fully described in the *Proceedings* of the American Academy, in whose service he travelled, but also extended most materially our geographical knowledge of a country at that time very little known. It is to Du Chaillu that geographers are indebted for the knowledge that the Muni, Munda, and the tributaries of the estuary of the Gabon are mere coast rivers, but that the St. Nazareth, Mexias, and Fernando Vaz are the deltaic arms of the Ogowe, a vast river rising far in the interior. Du Chaillu may, likewise, claim to have been the first European who killed a gorilla in his native wilds. The account of his 'Explorations and Adventures in Equatorial Africa' (London, 1861), a strikingly attractive volume of travels, was enthusiastically received by the general public, but severely criticized by a number of distinguished zoologists and geographers. The former questioned many of his statements as to the natural history of the country explored, and utterly refused to accept his statements as to the habits and ferocity of the gorilla. Among the latter, Dr. H. Barth (*Zeitschrift für Erdkunde*, vol. x., 1861) compared the dates in the published volume with those of letters previously published in America, and "regretfully" arrived at the conclusion that many of Du Chaillu's statements, more especially those referring to journeys into the interior, were fictitious (*erlogen*). The discrepancies in the dates are undeniable, but the confusion is due to the fact that Du Chaillu, at that time still a young man not fully master of English, and without experience as an author, sought the collaboration of a journalist, who thought fit to disregard the chronological order of events in favour of a geographical arrangement. It is obvious that if it had been intended to deceive the public, care would have been taken to arrange so simple a matter as the sequence of dates.

Du Chaillu, however, was not quite without supporters. Sir Richard Owen recognized the high value of his collections. Winwood Reid, whilst denying that Du Chaillu ever killed a gorilla, confirmed his accounts of the country and people; whilst Dr. Lenz does the same with special reference to the Muni, although he considers his predecessor's account to be "somewhat fantastic."

* In a lecture before the American Geographical Society, on January 5, 1860, he said:—"Before starting on my return I raised the flag of the United States, my country by adoption, and by its side the Tricolor of France, my native land."



PAUL B. DU CHAILLU.

From a photograph by Messrs. J. Thomson, 70a Grosvenor Street, W.

Du Chaillu, naturally, was much irritated by the many doubts expressed as to his veracity, and being at the same time fully aware of his shortcomings as a scientific explorer, he underwent a course of instruction for making astronomical observations, and then resolved to return to the scene of his former labours. He expended nearly all the money obtained by the sale of his book to freight a ship, and left Gravesend on August 5, 1863, for the Fernando Vaz. At the very outset he met with a disaster, for on October 15 his boat was swamped in the surf, and most of his instruments were lost. A fresh supply had to be procured, and thus it was that his departure for the interior was delayed until October, 1867. Passing through the country of the Ashira, he crossed the great southern tributary of the Ogowe in the Apono country considerably higher up to what he had done during his first expedition, and discovered a village of Obongo dwarfs in the country of the Ishogo; but, unfortunately, the accidental killing of a native in an Ashango village by one of his followers led to hostilities, and Du Chaillu was compelled to beat a hasty retreat to the coast, leaving behind him all of his photographs and collections, and merely saving his journal. His hope of being able to reach the Congo, or even the upper Nile, had thus been frustrated. The map which accompanies the account of the expedition, 'A Journey to Ashango Land' (London, 1867), is based upon fifteen observed latitudes and seven longitudes, and up to this day it is the only authority on the geography of the greater part of the country delineated. It proves at the same time that the sketch-map published previously had conveyed a very fair notion of the general features of the country. This achievement was rewarded by the Royal Geographical Society by electing Du Chaillu one of its honorary members.

After a few years spent in the United States, in the course of which he delivered lectures and wrote several books for young folk,* who were very fond of "old Paul," Du Chaillu travelled in Scandinavia. The fruits of this expedition were a delightful book of travel, 'The Land of the Midnight Sun' (London, 1881), and an ambitious historical work on 'The Viking Age' (London, 1889), a work full of information, although its readers will hardly accept the author's conclusion that the English-speaking communities derive their remarkable energy and love of the sea from the warlike and ocean-loving tribes of the Scandinavian North.

Du Chaillu's body has been embalmed, and, by desire of his friends, will be forwarded to America.

E. G. Ravenstein.

Obituary of the Year.

The following is a list of the Fellows who have died during the year 1902–1903 (April 30):—

Admiral E. S. Adeane; General W. C. Bancroft; Colonel A. F. Barrow; Lieut.-General R. S. Baynes; Robert Berridge; Dr. Isambard Brunel; William Bull; A. D. Campbell; Samuel Horace Candler; Lord Cheylesmore; Robert Clark; Sir Daniel Cooper; Arthur Copeland-Griffiths; Nathaniel Cork; James Cornwell; Sir John W. Cox; W. B. Cracknall; George A. Craig; Dr. W. H. Crosse; Donald Cruikshank; George Danford; Sir Juland Danvers; Sir Robert Henry Davies; C. S. Dicken; Joshua Ellison; Patrick F. Evans; W. D. Fane; J. Dunn Gardner; J. H. Gladstone; Matthew Gray; Right Hon. R. W. Hanbury; L. C. Henry; Sir Edward Hertslet;

* Among Du Chaillu's minor works are 'Stories of the Gorilla Country' (1867); 'Wild Life under the Equator' (1868); 'Lost in a Jungle' (1869); 'My Apingi Kingdom' (1870); 'The Country of the Dwarfs' (1871); 'The Land of the Long Night' (1900).

Sir ARTHUR HODGSON; E. A. HUGHES; P. J. HUGHES; R. IRVINE; Major T. G. JOHNSON; H. C. LANGTON; SYAD MOHAMMED, KHAN BAHADUR LATIF; J. A. H. LOUIS; Colonel C. R. MACGREGOR; CHARLES GILBERT MASTER; J. OAKLEY MAUND; PHILIP MICHELMORE; A. MICHIE; Admiral H. M. MILLER; Captain A. B. MOLESWORTH; Colonel J. MORLAND; J. LINTON PALMER; J. DICKSON PARK; CHARLES PHARAZYN; GEORGE PHILIP; JOSIAH PIERCE, jun.; Dr. WORDSWORTH POOLE; HENRY PORTER; Major J. W. POWELL; Rev. T. W. PRICKETT; Dr. G. RADDE; JULIAN RALPH; Canon RAWLINSON; H. C. ROSS; EDWARD RUSSELL; THOMAS RUDD; W. A. SANFORD; Dr. KARL VON SCHERZER; Captain WM. FRANCIS SEGRAVE; JAMES SHAND; WM. SHAWE; Field-Marshal Sir J. L. A. SIMMONS; H. D. SKRINE; Captain W. H. SMITH; HOWARD SPENSLEY; Lieut. H. T. G. STACK; General J. A. STEEL; Sir A. K. C. STEPNEY; R. A. STERNDALE; JAMES STEVENSON; J. S. TAYLOR; A. S. TRUMAN; GEORGE VACHER; J. D. W. VAUGHAN; THOMAS WARD; Captain WM. WATSON; E. W. WHINFIELD; J. A. WILLANS; E. E. WOOD; Major H. J. P. WOODHEAD.

CORRESPONDENCE.

The "Tanganyika Problem."

IT is probable that any military leader must feel unmixed delight when, after a preliminary attack upon a hostile country, he sees his adversary's forces taking up exactly those positions from which he knows they must retreat, and their evolutions being conducted in a manner that will ensure his own entire victory.

I do not pretend to know whether any one ought to have such feelings, but I must plead guilty to having experienced something of this sort growing within me while I read in your last issue Dr. Blanford's article upon the position I have occupied with respect to the Tanganyika problem. The essay opens with a kindly reference to the extent and thoroughness of the work accomplished by the two African enterprises which I had the honour to command, and for this, especially in the interests of those I served, I am duly grateful. Moreover, I am further almost as much surprised as gratified to find that so eminent a geologist as Dr. Blanford now completely accepts my main contention, namely, that the halolimnic fauna of Lake Tanganyika is a marine relic, for I have a vivid recollection of the geological opposition which existed to this view when I first began to talk about the matter in 1897. But although he thus receives the major portion of my solution of the problem far more favourably than I had anticipated, Dr. Blanford at the same time sets out to accomplish what he evidently considers to be the complete slaughter of a number of the minor points I raise. The matters in question consist of views and statements concerning the geology of Central Africa, the distribution of its fishes and mollusca, and the origin of fresh-water faunas in general. They are thus of some general importance, and Dr. Blanford will consequently perhaps forgive me if I now in turn proceed to point out to your readers that, after carefully surveying the effect of his attack, the matters in question appear to be not even scotched, far less slain, while the explosive arguments he uses have had such a nasty habit of going off inside his own trenches, that the actual "butcher's bill" has been greater there than in the positions he intended to assault. But to the point. Dr. Blanford, after reviewing the reasons which I gave for regarding the Drummond formations as marine, remarks that "the bivalve shells of Tanganyika are exclusively fresh-water types." This is great news! I have intentionally avoided saying anything about the actual affinities of the bivalves of Tanganyika, because I do not at present feel

competent to deal with the matter, but I have a strong impression that several of these shells, notably the so-called *Unio burtoni* and others, have been wrongly placed by the conchologists, while the very similar shells from Drummond's beds were regarded by Prof. Rupert Jones, at any rate the last time I saw him, as esturine forms. Under these circumstances, would any cautious person affirm, as Dr. Blanford does, that the shells in question were "exclusively fresh-water types"? My critic then continues, "The echinoderm noticed by Dr. Gregory was of doubtful origin, and Oliocene (*sic*) age," so that it clearly could not have come from Drummond's beds. Well, but is it an Oligocene species, or if so, is this species possibly Triassic also? Continuing, Dr. Blanford says of the Drummond beds, "It is more likely that they, as in the case of their South African representatives, are of fresh-water origin and very largely fluviatile." It is difficult to know where to begin with this series of assertions, since the latter part is based on an erroneous assumption in the first, but at a venture it may be stated for general information that these beds are like nothing at all in South Africa, and whether they are marine or not, they are certainly not fluviatile, unless deposits like our Lancashire limestones are to be considered as having originated in rivers. My critic proceeds, however, in this matter apparently under a sense of insecurity, for he remarks, "The point would hardly have been raised but for the circumstance that Mr. Moore has attacked what he calls Murchison's erroneous hypotheses concerning African stability. If, however, the strata here termed Drummond's beds are of inland origin, Murchison's views are not very far wrong, and the theory that Central Africa is an ancient land-mass is greatly strengthened." With respect to the first part of this contention, I would refer your readers to the original statement of Murchison himself, the whole statement as it stands with its reference to the absence of volcanoes south of the equator and the rest of it, and then to the simple geographical facts which were observed by Götzen and others before me; while with respect to the latter part of the above citation, the answer is already contained in the preceding paragraph.

Dr. Blanford is still further dissatisfied with my term "eurycolpic fold," which he translates "broad bosomed," and then criticizes. If, however, he will look the word up again more carefully, he will find that it means ridged and furrowed like the sea, or like the folds in a garment, as well as broad bosomed, and I really must protest on my own part against his suggestion of "trough-valley," for a more unsightly and evil-sounding expression it is difficult to imagine. In this connection my critic also makes the uncommonly true assertion that the difficulty of accounting for the rift-valleys is not removed by renaming them. There is, however, some reason why horribly cacophonous colloquial names like "graben," "rift-valley," and "trough-valley," which all mean different things, and none of which describes the folds in question, should be discontinued, and I may as well reassert that these valleys are usually folds; they are not "longitudinal blocks let down by trough faults," as Dr. Blanford dogmatically asserts.

It is thus obvious that there is some difference of opinion between me and Dr. Blanford upon these more purely geological by-products of the Tanganyika investigations, and it will also be apparent that there is reason to suppose that they may not be settled in the manner Dr. Blanford appears to anticipate. We may now turn to the more purely zoological questions relating to the same subject. But in so doing, I should like to get at the exact meaning of Dr. Blandford's expression that here "we enter upon debatable ground" (p. 271). If he means that he himself, as a geologist, feels less competent to deal with the matters in question, I am quite content, and his case is proportionately weakened. But if he means that the zoological evidence is more debatable, *i.e.* less clear than the geological, I would

refer your readers to p. 338 of my recent work, where, speaking of some of these very matters, I have said, "The problem is not one which it appears can be solved along geological lines, but the facts of zoology are before us, and are plain enough to any one who likes to take the trouble to understand them; and if the negative geological appearances of Central Africa remain, and in reality cannot be brought into accord with them, this simply shows the impotence of the geological, as compared with the zoological, methods of research—zoological evidence having, in fact, to be brought forward to indicate to geology the gross outline of the past history of Africa, and the way out of the theoretical entanglements in which it is at present wrapped up." Thus, if what I have just suggested should be Dr. Blanford's meaning, I see as little truth in his assertion as I fancy any one else will.

Moreover, Dr. Blanford often appears to be under a misconception as to whose views he is attacking, for I have expressly stated that I have adopted Dr. Gunther's idea that the fresh-water fishes of Africa appear to have spread out from a point of origin to which Tanganyika would correspond, and it is therefore obvious that the notion that the Cichlidæ have spread themselves in this way from Tanganyika is not my invention, whether it is true or not. The views respecting the origin of fresh-water faunas in general, which are given in the second chapter of my work, are expressly stated to be something distinct and independent from the main object of the book itself. These hypotheses may be "startling," as Dr. Blanford puts it, but whether they are a return to pre-Darwinian days does not appear to me to matter much if they are on the right track. To use his own manner of criticism, Dr. Blanford "cannot be acquainted with all that has been written" since Darwin's time upon the sporadic origin of genera, but he will find that the subject was very lately considered and seriously advocated by Huxley in a paper in which he deals with the distribution of the Alpine gentians. I am further asked, if the fresh-water mollusca have originated from the marine fauna of a single geological age, where are the marine forms from which they have sprung? Well, I was under the impression that the so-called *pseudo-melanias* of the ancient oceans were conchologically indistinguishable from the fresh-water representatives of the genus *Melania*, and there are several others that could be named. Further, with respect to the migration of fresh-water organisms, Darwin certainly showed that the young of some mollusca could be carried on birds' feet, and Lyell did the like in a number of other cases, but what is to be said to the non-existence of the Tanganyika forms in Kela or Kivu, both of which are in direct water connection with Tanganyika? I want information about this, while with respect to the pretty obviously greater migratory powers of vertebrates, we have one fish, *Tilapia burtoni*, which has actually gone up the Rusisi river into Kivu, thereby showing that vertebrates do migrate more quickly than the molluscs in question, whatever Darwin thought. Continuing, Dr. Blanford remarks, "The specific differences between the different African lakes, strongly and repeatedly insisted upon by Mr. Moore as evidence of a separate origin of the mollusca inhabiting these sheets of water, will not weigh much with those who know on what trivial differences species of fresh-water mollusca are founded." Really, nothing could please me more than the latter part of this expression of Dr. Blanford's present views, for, in spite of much abuse from valued friends, I have always regarded conchology as somewhat "trivial"—as, in fact, more of a waste of time than a science; but concerning the main contention, I would ask my readers and Dr. Blanford himself, either to make themselves acquainted with the shells, radulæ, and anatomy of the different species of *Vivipara*, *Melania*, *Planorbis*, *Limnea*, and *Planorbia* occurring in the different African lakes, or to take my word for it that in all these instances the differences are not "trivial," and if they are not, supposing Darwin's opinion concerning the

migratory capacities of these forms be correct, how is it that they have not intercolonized in the different African lakes, some of which are actually in water connection one with another?

Finally, Dr. Blanford challenges my view with respect to the origin of certain forms of fresh-water fishes in America and Africa from an intervening ocean, and points out that I have not taken into account the supposed existence of a land connection between these continents in former times. "Mr. Moore," he says, "cannot be acquainted with all that has been written, both by biologists and geologists, as to the existence of a former land connection between Africa and America." Well, but what if I had read Suess's 'Antlitz der Erde,' if I knew something of Beddard's and Neumayer's observations, if I have also a vivid recollection of several discussions with Dr. Gregory upon this very subject, and if, after all this, I had and still "hae mi doots" about there ever having been any connection between the continents at all, was it necessary for me to dispute the matter with all these worthy people while dealing with another subject? I think it was far better not, for, as a great man said on a similar occasion, "one likes to be on good terms with one's contemporaries."

J. E. S. Moore.

Canadian Rocky Mountains.

Prof. Coleman, in his interesting paper on the Brazeau Ice-field, published in the May number of the *Geographical Journal*, calls attention to several points in connection with the Canadian Rocky Mountains. Firstly, he complains, and with reason, that in the former maps which the Geographical Society published to illustrate two papers of mine on the Rocky mountains of Canada, no mention was made of the work done by Mr. Stewart, although a portion of his map dealing with Fortress lake, the Athabasca pass, the Brazeau and Cataract rivers, had been copied. As Mr. Stewart's map is a most excellent and interesting one, covering a stretch of country over 150 miles long, from Morley to the Athabasca pass, this omission is much to be regretted. In the new map, however, which appeared in the last number of the *Journal*, this unfortunate mistake has been rectified. Secondly, Prof. Coleman objects to a statement of mine, that my explorations had been on the "eastern" side of the Rocky mountains. Surely the eastern side of the Rocky mountains comprises that part which lies east of the watershed, and as my explorations were all on that side, it is perfectly justifiable to say they were on the eastern side of the mountains. Thirdly, Prof. Coleman calls attention to the use of the name "Wapta" for one of the branches of the Kicking Horse river. It certainly seems a pity that a word meaning simply "river" should be given to one particular stream, and more especially so as the name for the glacier out of which that stream rises has consequently been named the Wapta glacier.* Another case of wrong nomenclature noticed by Prof. Coleman is that of the Whirlpool river, by Mr. Wilcox. In all the earlier accounts of the Athabasca pass, the Whirlpool river is made to run north-east from the Athabasca pass.

Lastly, Prof. Coleman mentions in his paper, that on looking up Cataract river "were splendid cathedral-shaped mountains, the most prominent of which we named Minster mountain. This peak is well seen from the prairie land of the Kootenay plains." These mountains are probably the same as those mentioned by Alex.

* The name Wapta for the Kicking Horse river has been condemned by the Geographic Board of Canada (see Annual Reports).—Ed. *G. J.*

Henry in his diary, February 7, 1811, at the time when he visited the Kootenay plains. To quote: "at eleven o'clock we passed the entrance of Rivière du Meurleton (Cataract river?). The course can be seen to wind for a long distance westward. Along this river I observed a high, steep mountain of singular shape, like a wall surrounded by a moat and ramparts, with an elevated central summit resembling a citadel, the whole having the appearance of a commanding fortress." * This mountain he called Mount Meurliton.

J. NORMAN COLLIE.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1902–1903.

Eleventh Ordinary Meeting, April 27, 1903.—Sir CLEMENTS MARKHAM, K.C.B., F.R.S., President, in the Chair.

ELECTIONS:—*Rev. George Thos. Basden; Arthur Baume; Lieut. John Percy Boyd-Carpenter, R. Scots Fusiliers; Captain C. E. G. Charlton, R.A.; Major C. M. Dobell, D.S.O., R. Welsh Fusiliers; Joseph Charles Harvie; James P. Hoyne; Henry Mahler; Lieut.-Colonel Courtenay Clarke Manifold; Arthur Richmond; Frederick Bentfield Seaman; Henry Horace Seelig, Ph.D.; Charles John Ford Sevier.*

The Paper read was:—

"Four Years' Arctic Exploration in the *Fram*." By Captain Otto Sverdrup.

The Patron's Medal, awarded by the Council, was presented to Captain Sverdrup before the reading of the Paper.

Twelfth Ordinary Meeting, May 11, 1903.—Sir CLEMENTS MARKHAM, K.C.B., F.R.S., President, in the chair.

ELECTIONS.—*William Frederick Bailey; William John Bernard Blew; Rev. Guy Julian Bridges; Clarence Ludlow Brownell; Herbert William Cadoux; Captain Archibald Neil Campbell, R.A.; Osbert Chadwick, late R.E.; Arthur John Chivers; Henry Augustus Frederick Currie; Lieut. L. J. H. Dickinson, 3rd Batt. Royal Dublin Fusiliers; Dugald Stewart Gilkison; Dugald Stewart Gilkison, Scottish Rifles; William Joseph Kenny; Donald Smallpiece, L.R.C.P.; Captain Arthur John Newman Tremearne, Victorian Mounted Infantry; Captain H. E. Trevor, Yorkshire Light Infantry; Captain C. H. Turner, Suffolk Regiment; Henry Hutchinson Spiller; Francis John Waring, C.M.G.; William Webster.*

HONORARY CORRESPONDING MEMBER.

Prof. Otto Krummel.

The Paper read was:—

"Cilicia, Tarsus, and the Great Taurus Pass." By Prof. W. M. Ramsay.

* 'Journals Alex. Henry,' 1799–1814, edited by Elliott Coues, pp. 685, 686.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.	Mag. = Magazine.
Abh. = Abhandlungen.	Mem. = Memoirs, Mémoires.
Ann. = Annals, Annales, Annalen.	Met. = Meteorological.
B. = Bulletin, Bollettino, Boletim.	P. = Proceedings.
Com. = Commerce.	R. = Royal.
C. Rd. = Comptes Rendus.	Rev. = Review, Revue.
Erdk. = Erdkunde.	S. = Society, Société, Selskab.
G. = Geography, Geographie, Geografia.	Sitzb. = Sitzungsbericht.
Ges. = Gesellschaft.	T. = Transactions.
I. = Institute, Institution.	V. = Verein.
Iz. = Izvestiya.	Verh. = Verhandlungen.
J. = Journal.	W. = Wissenschaft, and compounds.
k. u. k. = kaiserlich und königlich.	Z. = Zeitschrift.
M. = Mitteilungen.	Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Austria—Herzegovina. *Globus* 83 (1903): 191–194. **Katzer**

Das Popovo polje in der Hercegovina. Von Dr. F. Katzer. *With Illustrations.*

Austria—Innsbruck. *Globus* 83 (1903): 157–160. **Jaeger.**

Innsbruck. Eine erdgeschichtliche Betrachtung. Von J. Jaeger.

Austria—Trieste. *Ann. Hydrographie* 31 (1903): 116–117. ——

Gegenwärtige und zukünftige Hafenanlagen von Triest. *With Plan.*

Belgium. *B.S. Belge Géologie* 16 (1902): 517–521. **Ertborn.**

Quelques mots au sujet de l'hydrologie de la côte belge. Par le baron O. van Ertborn.

Denmark—Limnology. **Wesenberg.**

Oversigt K. Dansk. Vidensk. S. Forhand. (1902): 257–303.

Sur l'existence d'une faune relicte dans le lac de Furesö. Par C. Wesenberg-Lund. *With Map.*

Europe. **Herbertson**

Descriptive Geographies from Original Sources. Europe. Selected by F. D. Herbertson. Edited by A. J. Herbertson. London: A. & C. Black, 1903. Size 7 × 4½, pp. xxiv. and 300. *Price 2s. 6d. Illustrations. Presented by the Publishers.*

France. *B.S. Belge Géologie* 16 (1902): 209–283. **Cooreman and Dollfus.**

Compte rendu des excursions de la Session extraordinaire de la Société belge de Géologie, etc., dans les départements français de la Marne et de l'Aisne (du 8 au 15 août 1901). Par T. Cooreman et G. Dollfus. *With Map and Illustrations.*

France—Brittany. *Ann. G.* 12 (1903): 19–30. **Vallaux.**

Sur les oscillations des côtes occidentales de la Bretagne. Par C. Vallaux.

See note in the Monthly Record (*ante*, p. 668).

France—Historical. **Lavisse and Blache.**

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Nevai di circo e traccie carsiche e glaciali nel gruppo del Cavallo. Del Prof. L. Marson. *With Illustrations.*

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Några anteckningar rörande Gammelstadens geografi. Af J. Forsman, jun. *With Maps and Illustrations.*
On the physical conditions in the neighbourhood of Helsingfors.

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Några iakttagelser öfver vattendelaren vester om Kyrö älf. Af R. Hammarström.
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L'Oural est-il montagne d'Europe ou d'Asie? Par Jean Bertrand. (Extrait du

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Sur l'existence de plusieurs mouvements oro-géniques successifs dans l'Oural du Nord. Note de L. Duparc, L. Mrazec, et F. Pearce.

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The Tale of a Tour in Macedonia. By G. F. Abbott London: E Arnold, 1903 Size 9½ × 6, pp. xii. and 344. *Map and Illustrations. Price* 14s. *net. Presented by the Publisher.*

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The editor's notes on the physical geography of the groups are concluded in this part.

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Vulkanischer Ausbruch auf Torishima. Von Max Kutschera.

See note in the April *Journal* (p. 436).

Malay Archipelago—Borneo. **Molengraaff.**
Borneo Expedition. Geological Explorations in Central Borneo (1893–1894). By Dr. G. A. F. Molengraaff. English Revised Edition, with an Appendix on fossil Radiolaria of Central Borneo by Dr. G. J. Hinde. With Atlas of Geological Maps. Published by the Society for the Promotion of the Scientific Exploration of the Dutch Colonies. Leyden: E. J. Brill; Amsterdam: H. Gerlings. 1902. Size 11¼ × 7½ (Atlas Folio), pp. xx., 580, and 56. *Maps, Plates, and Illustrations. Price* £2 12*s* 6*d*.

The Dutch edition of this work was reviewed in vol. xviii. of the *Journal* (p. 295).

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Naar de Boven-Kelei (Sambalioeng). Een reis in de binnenlanden van Borneo (26 Augustus—17 September 1901). Door A. H. Spaan. *With Map.*

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The State of North Borneo. By H. Walker.

Malay Archipelago—Celebes. **Hasselt.**
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Nieuwe onderzoekingstochten van Dr. Paul Sarasin en Dr. Fritz Sarasin op Celebes. Door A. L. van Hasselt.

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Nota omtrent het stroomgebied der Boelian, Djeba, en Djangga. Van O. L. Helfrich.

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Apontamentos para um diccionario chorographico de Timor. Por R. Dores.

Malay Peninsula. **Swettenham**
Malay Sketches by Sir Frank Athelstane Swettenham. London, etc.: J. Lane, 1903. Size 8 × 5, pp. xii. and 290. *Price* 6*s. Presented by the Publisher.*

This is a re-issue of the original work which appeared in 1895.

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The Persian Problem. An Examination of the Rival Positions of Russia and Great Britain in Persia, with some account of the Persian Gulf and the Bagdad Railway. By H. J. Whigham. London: Isbister & Co., 1903. Size 9 × 5½, pp. xvi. and 424. *Maps and Illustrations.*

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Greater Russia. The Continental Empire of the Old World. By Wirt Gerrare. London: W. Heinemann, 1903. Size 9¼ × 6, pp. xiv. and 310. *Map and Illustrations. Price* 18*s*. [To be reviewed.]

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The Exploration of the Caucasus. By Douglas W. Freshfield. Second Edition. 2 vols. London: E. Arnold, 1902. Size 10 × 7½, pp. (vol. i.) xii. and 278; (vol. ii.) viii. and 290. *Maps and Illustrations. Price* 21*s. net. Presented by the Author.*

Many readers, to whom the price of the first edition was prohibitive, will welcome the appearance of a popular edition of this work. Even without the superb full-page plates of the original, there are sufficient illustrations in the text to give a good idea of the general features of the range and the characteristics of its scenery.

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Sur les laccolites du flanc nord de la chaine du Caucase. Note de M^{lle} Véra Dervis.

Russia—Caucasus—Archæology. **Uwarow.**
Die Sammlungen des Kaukasischen Museums im Vereine mit Special-Gelehrten bearbeitet und herausgegeben von Dr. Gustav Radde. Band. v. Archæologie bearbeitet von Gräfin P. S. Uwarow. Tiflis, 1902. Size 12½ × 8½. pp. xv. and 192. *Plates and Illustrations. Presented by Dr. Gustav Radde.*

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De Sardes á Cunaxa. Estudio geográfico. Por A. Blazquez. *With Map.*

Turkey—Asia Minor. Z. Ges. Erdk. Berlin (1903): 122–137. **Brennecke.**
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Preliminary Report to the Wilson Trustees on Two Journeys in Asia Minor, 1901 and 1902. By W. M. Ramsay. The Aberdeen University Press, Limited. Size 11 × 7½, pp. 14.

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Sur les reconnaissances géographiques exécutées dans la région du Tchad. Note de — Destenave.

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Rapports sur les îles du lac Tchad. Par le lieutenant-colonel Destenave.

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Reconnaissance géographique de la région du Tchad par le lieutenant-colonel Destenave et par les officiers placés sous ses ordres.

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Die Elisabeth-Bucht, Südwestafrika. Nach Bericht S.M.S. *Wolf*, Komdt. Kaptlt. Bechtel.

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La zone forestière de la haute Côte d'Ivoire occidentale.

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Sur la géologie de la Montagne des Français (Madagascar). Note de P. Lemoine.

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De Tamatave a Tananarive. Par — de Roquefeuil. *With Maps.*

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Comment nous connaissons Madagascar. Par H. Froidevaux.

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Marokko. Eine länderkundliche Skizze. Von T. Fischer.

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Documents sur le Nord-Ouest Africain. Étude sur l'Hygiène et la Médecine au Maroc suivie d'une Notice sur la Climatologie des Principales Villes de l'Empire. Par le Dr. L. Raynaud. Alger: Imp. Typ. et Lithographique S. Léon, 1902. Size 10 × 6½, pp. 204. *Illustrations. Presented.*

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Figuig. Notes et impressions. Par E. Doutté. *With Map.*

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Le Niger, voie ouverte a notre empire Africain. Par M. le Capitaine Lenfant. *With Maps and Illustrations.*

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La navigation du Moyen Niger et l'avenir du Soudan français. Résumé de la Conférence du Capitaine E. Lenfant. *With Map.*

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North Africa—Historical. *B.S.G. Italiana* 3 (1903): 1012–1039. **Garofalo.**
Contributi alla Geografia storica dell' Africa. Nota del Prof. F. P. Garofalo.

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The British South Africa Company. Report upon the Present Condition of Rhodesia, presented to the Directors, by J. F. Jones, C.M.G., 1903. Size 10½ × 8½, pp. 44. *Map and Diagram.*
See note in the April number (p. 456).

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Le commerce du Sahara. Par E. Fallot. *With Map.*

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Sur un type spécial de dunes de la bordure saharienne. Note de B. P. G. Hochreutiner. [See note, *ante*, p. 556.]

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The Trade and Industry of South Africa. By B. H. Morgan.

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De Cádiz á Fernando Póo y al Muni. Diario del viajo de D. Pedro Jover y Tovar. *With Portrait.*

West Africa—Cotton. *J. African S.* **2** (1903): 132-148. **Baillaud.**
Cultivation of Cotton in Western Africa. By E. Baillaud.

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The Michipicoten Iron Ranges. By A. P. Coleman and A. B. Willmott. (University of Toronto Studies. Geological Series, No. 2.) The University Library: Published by the Librarian, 1902. Size 11 × 7, pp. 48. *Maps.*

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Notes on a Section across the Sierra Madre Occidental of Chihuahua and Sinaloa, Mexico By W. H. Weed. (*Transactions of the American Institute of Mining Engineers.*) 1901. Size 9½ × 6, pp. 16. *Section.*

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Annual Reports of the War Department for the fiscal year ended June 30, 1902. Report of the Chief of Engineers. 4 Vols. and Supplement. Washington, 1902 Size 9½ × 6, pp. 3266 and 216. *Maps, etc. Presented by the U.S. War Department.*

Includes, as usual, the report of the Mississippi Commission and much information on the improvement of harbours, navigation, etc.

United States—California. **King.**
Mountaineering in the Sierra Nevada. By Clarence King. London: T. Fisher Unwin, 1903. Size 8 × 5½, pp. xiv. and 378. *Price* 6s. *net. Presented by the Publisher.*

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The Arapahoe Glacier in 1902. By N. M. Fenneman. *With Illustrations.*

United States—Great Salt Lake. *National G Mag.* **14** (1903): 75-77. **Murdoch.**
Why Great Salt Lake has fallen. By L. H. Murdoch.

See note in the Monthly Record (*ante*, p. 676).

United States—Idaho. *B. United States Geol. Surv.*, No. 199 (1902): pp. 192. **Russell.**
Geology and Water Resources of the Snake River Plains of Idaho. By I. C. Russell. *With Map and Illustrations.*

United States—New Mexico. *American J. Sci.* **15** (1903): 207-210. **Keyes.**
Geological Structure of New Mexican Bolson Plains. By C. R. Keyes.

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La frontière argentino-chilienne. Par L. Gallois. *With Map.*

Argentine Republic. *J. Franklin I.* **155** (1903): 213-235, 241-272. **Corthell.**
Two Years in Argentine as the Consulting Engineer of National Public Works By E. L. Corthell.

Brazil—Amazon. *Ann. G.* 12 (1903): 54–66. **Le Cointe**
Le Bas Amazone. Par P. Le Cointe. *With Map and Plates.*

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À travers l'Amérique Équatoriale. L'Amazonie. Par Auguste Plane. Paris: Plon-Nourrit et Cie, 1903. Size 7½ × 4½, pp. xiii. and 280. *Maps and Plates. Presented by the Author.*

Brazil—Rubber Industry. *Petermanns M.* 49 (1903): 28–32. **Kahler.**
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Bericht über eine Reise im venezolanischen Guyana. Von Dr. S. Passarge. *With Maps and Illustrations.*

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The Panama Canal Treaty.

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Zur Kenntnis der Gefässpflanzen des südlichen Patagoniens. Von P. Dusén. *With Illustrations.*

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Two Ascents of the Soufrière. By Tempest Anderson. *With Illustrations.*

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À travers l'Amérique du Sud. Explorations des Frères Reyes. Travail présenté à la 11e Conférence Pan-Américaine réunie au Méxique. Par le Général R. Reyes, délégué de Colombie. México-Barcelona: R. de S. N. Araluce, 1902. Size 15 × 11, pp. 88 and 40. *Map. Presented by the Author.*

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Une première occupation allemande au Vénézuéla (XVIe siècle). Par G. Figueiras

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On the Birds of the Orinoco Region By Count Hans von Berlepsch and Ernst Hartert. (From *Novitates Zoologicæ*, vol. ix., April, 1902.) Size 11 × 8. *Plate Presented by Mr Ernst Hartert.*

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A Statistical Account of the Seven Colonies of Australasia. 1901-1902. By T A. Coghlan. Ninth issue. Sydney: W. A. Gullick, 1902. Size 9 × 5½, pp. viii. and 1094. *Map. Presented by the Agent-General for New South Wales.*

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New Guinea—Dutch. **Moolenburgh.**
Tijds. K. Ned. Aard. Genoots. Amsterdam 20 (1903): 206–221.
Reis door het smalste gedeelte van Nederlandsch-Nieuw-Guinea. Door P. E. Moolenburgh.

New South Wales. *Rev. Colon.* (1902): 279–311. **Vigouroux**
Mission Vigouroux (Océanie).
Reports on farming industries, etc, in New South Wales.

New Zealand. **Dadelszen.**
Report on the Results of a Census of the Colony of New Zealand, taken for the night of the 31st March, 1901. By E. J. von Dadelszen. Wellington, N.Z., 1902. Size 11 × 8½, pp. viii. and 164.

POLAR REGIONS.

Arctic—Abruzzi Expedition. **Filippi.**
Filippo de Filippi. La spedizione polare artica di S.A.R. il Principe Luigi Amedeo di Savoia, Duca degli Abruzzi ed il suo libro. (Dalla *Nuova Antologia*, 16 dicembre 1902.) Roma, 1902. Size 9½ × 6½, pp. 20. *Portrait. Presented by the Author.*

Arctic—Sverdrup Expedition. *G. Tidskrift* 16 (1901–1902): 193–194. **Isachsen.**
En Kort Oversigt over den anden norske Polarfærds geografiske Arbejde. Af Ritmester Isachsen. *With Map.*

Greenland. *Bihang K. Svensk. Vet.-A. Handlingar* 27 (No. 3) (1901): pp. 70. **Dusén.**
Zur Kenntnis der Gefässpflanzen Ostgrönlands. Von P. Dusén. *With Map and Plates.*

Greenland. *G. Tidskrift* 16 (1901-1902), 211-217. **Kruuse.**
Angmagsalikerne. Ethnografiske Iagttagelser paa en Expedition til Angmagsalik. Ved C. Kruuse.

Greenland and Jan Mayen. **Dusén.**
Bihang K. Svensk. Vet.-A. Handlingar 27 (No 1) (1901): pp. 71.
Beiträge zur Laubmoosflora Ostgrönlands und die Insel Jan Mayen. Von P. Dusén. *With Map and Plates.*

MATHEMATICAL GEOGRAPHY.

Cartography. *Petermanns M.* 49 (1903): 45-47. **Hammer.**
Beiträge zur russischen Militärkartographie. Von Prof. Dr. E. Hammer.

Nautical Astronomy. *Ann. Hydrographiques* (1902): 7 129. **Arago.**
Essai d'une méthode de calcul commune aux distances lunaires et occultations. Par Capitaine — Arago.

Nautical Astronomy—Longitude. *Ann. Hydrographiques* (1902): 130-137. **Caspari**
Note sur une nouvelle méthode de calcul de la longitude par les distances lunaires. Par E. Caspari.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geology—Agricultural. **McConnell.**
The Elements of Agricultural Geology. A Scientific Aid to Practical Farming. By Primrose McConnel. London: Crosby Lockwood & Son, 1902. Size 10 × 6, pp. 330. *Map and Illustrations. Presented by the Publishers.*

Geology—Plan of the Earth. *Petermanns M.* 49 (1903): 43-45. **Dannenberg.**
Die Äquatorfrage in der Geologie. Von Prof. Dr. A. Dannenberg.
Analysis of a work by Father Damian Kreichgauer.

Glaciers. *Tijds. K. Ned. Aard. Genoots. Amsterdam* 20 (1903): 159-174. **Baren.**
Het Alpine gletscherijs, zijne afzettingen en invloed op de vormen van het hooggebergte. Door J. van Baren. *With Illustrations.*

Glaciers—Moraines. *Petermanns M.* 49 (1903): 34-36. **Hess.**
Der Schuttinhalt von Innenmoränen. Von H. Hess.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Ethnology—Pigmies. *Verh. Naturforsch. Ges. Basel* 16 (1903), 85–117. **Kollmann.**
Die Pygmäen und ihre systematische Stellung innerhalb des Menschengeschlechtes. Von J. Kollman. *With Illustrations.*

Historical—Maps. **Crivellari.**
Giuseppe Crivellari. Alcuni Cimeli della Cartografia Medievale esistenti a Verona Firenze: B. Seeber, 1903. Size 9½ × 6½, pp. 48. *Facsimile maps. Presented by the Publisher.*
Contains a reproduction, in colours, of the 1442 planisphere of Leardo.

Lindeman. *Deutsch. Rundschau G.* **25** (1903): 325–327. **Wolkenhauer**
Dr. Moritz Lindeman. Von W. Wolkenhauer. *With Portrait.*

GENERAL.

Congress. *Z. Ges. Erdk. Berlin* (1903): 44–49. **Von den Steinen.**
Der XIII. Internationale Amerikanisten-Kongress. Von Prof. Dr. Karl von den Steinen.

Education. **Davis.**
The Progress of Geography in the Schools. By W. M. Davis. (The First Yearbook of the National Society for the Scientific Study of Education. Part ii.) Chicago, 1902. Size 9 × 6, pp. 58.

Education. *G.Z.* **9** (1903): 90–112. **Langenbeck.**
Ziel und Methode des geographischen Unterrichts. Von Prof. Dr. Langenbeck.

Encyclopædia. **Meyer.**
Meyers Grosses Konversations-Lexikon. Eine Nachschlagewerk des allgemeinen Wissens. Sechte, gänzlich neubearbeitete und vermehrte Auflage. Zweiter Band. Astilbe bis Bismarck. Leipzig u. Wien: Bibliographisches Institut, 1903. Size 10 × 6½, pp. 914. *Maps and Illustrations. Price* 10*s.*

Exhibition. *B.S.R.G. d'Anvers* **26** (1903): 259–422. **Janssens.**
Compte-rendu de l'Exposition cartographique, ethnographique et maritime d'Anvers. Par E. Janssens. *With Illustrations.*

Mountaineering. **Schäfer.**
Hochtouren in den Alpen, Spanien, Nordafrika, Kalifornien und Mexiko. Ausgeführt und beschrieben von Raimund Schäfer. Leipzig: J. J. Weber, 1903. Size 11 × 7½, pp. viii. and 176. *Illustrations. Presented by the Publisher.*

Telegraphy. **Tunzelmann.**
Wireless Telegraphy. A Popular Exposition. By G. W de Tunzelmann. Third Edition. London: *Knowledge* Office, 1902. Size 7½ × 5, pp. v. and 104. *Price* 1*s.* 6*d. Diagrams. Presented by the Publishers.*

NEW MAPS.

By E. A. REEVES, *Map Curator,* **R.G.S.**

EUROPE.

Austrian Alps. **Hess.**
Die Eisbedeckung in den Oetztaler Alpen seit dem Beginne der Eiszeit bis zur Gegenwart und Längsprofile des Venter Tales. Von H. Hess. Scale 1 : 250,000 or 3·9 stat. miles to an inch. *Petermanns Geographische Mitteilungen,* Jahrgang, 1903, Tafel 7.—Querprofile des Inn- und Oetz-Tales. Von H. Hess. Inn-Tal Profile mit interglazialen Talböden. Scale 1 : 150,000 or 2·3 stat. miles to an inch. Oetz-Tal Profile mit interglazialen Talböden. Scale 1 : 75,000 or 1·9 stat. mile to an inch. *Petermanns Geographische Mitteilungen,* Jahrgang, 1903. Tafel 8. Gotha: Justus Perthes. *Presented by the Publishers.*

Central Europe. **Liebenow and Ravenstein.**
Liebenow-Ravenstein's Special-Radfahrerkarte von Mittel-Europa. Scale 1 : 300,000 or 4·7 stat. miles to an inch. Sheets 52, Warschau; 64, Lódz; 65, Radom; 78, Wielun; 103, Prag; 104, Königgrätz; 105, Olmütz; 106, Bielitz. Frankfurt a. M.: Ludwig Ravenstein.

England and Wales. **Ordnance Survey.**
Ordnance Survey of England and Wales:—Revised sheets published by the Director-General of the Ordnance Survey, Southampton, from April 1 to 30, 1903.

4 miles to 1 inch:—

Hill-shaded map, printed in colours, in sheets 19 (21 and 25), 22, 23. 1*s.* 6*d. each.*

2 miles to 1 inch:—

Printed in colours, 88, 96, 1s. *each*; folded in covers or flat in sheets.

6-inch—County Maps:—

Bedfordshire, 19 S.W. **Cambridgeshire**, 4 N.W., 6 N.W., S.W., S.E., 7 S.W., S.E., 10 N.E., 11 N.W., N.E., S.W., 12 N.E., S.W., 15 N.W., N.E., S.E., 16 N.W., N.E., S.W., S.E., 21 N.W., N.E., S.W., S.E., 22 N.W., N.E., S.W., S.E., 25 N.W., N.E., S.E., 26 N.W., 29 N.W., N.E., S.W., 52 N.W., N.E., S.W., S.E. **Cardiganshire**, 2 N.E., 5 N.W. **Dorset**, 22 S.E., 38 N.E., S.E., 39 N.W., N.E., 40 S.E., 45 N.W. (N.E. and S.E.), 52 S.E. **Gloucestershire**, 5 S.W., 8 S.E., 11 S.E., 13 N.W., 15 S.W., 19 S.W., 28 N.W., S.W., 30 S.E., 38 N.E., 49 N.W., S.E., 51 N.W., S.W., S.E. **Monmouthshire**, 15 N.W., S.W., 21 N.W., S.W., 26 N.W., S.W., 31 S.W., 35 S.E., 40 N.E., S.W. **Montgomeryshire**, 16 N.E., 23 S.E., 24 S.W., 32 N.E., 40 N.W. **Shropshire**, 32 N.E., 37 N.W., 39 S.W., S.E., 41 S.W., 42 N.E., 43 S.W., 44 S.W., 48 S.W., 49 N.E., 50 N.E., 52 S.W. **Staffordshire**, 57 S.E. **Warwickshire (Det.)** 53 S.E. **Worcestershire and (Do. Det. 3 and 4)**, 51 S.E., 54 S.E., 56 N.W., 58 S.W. 1s. *each*.

25-inch—County Maps:—

Cambridgeshire, XLIX. 11, 14, 15, 16; L. 1, 5, 9; LX. 1, 2, 3, 4, 5, 6, 7, 8, 12, 16. **Dorset**, XI. 7; XXIX. 4, 14, 15 **Gloucestershire**, XVII. 1, 3, 7, 11; XVIII. 3, 14, 15; XXV. 2; XXIX. 15; XXXI. 4, 7; XXXII. 3, 4, 8; XXXIII. 9, 11, 12, 13, 15; XXXIX. 10; XL. 1; XLI. 10; XLII. 1; XLVIII 6, 11, 13, 16; XLIX. 10, 14; LV. 5, 6, 8, 10, 11, 12, 13, 14; LVI. 5, 6, 8, 9, 10, 11, 12, 13, 14; LVII. 2, 4, 6, 7, 8, 9, 10, 11, 12, 13; LIX. 5; LXIII. 1, 2, 4, 8, 10, 11, 15, 16; LXIX. 12. **Leicestershire**, V. 9, 10; X. 13; XV. 7, 11, 12, 16; XVI. 1, 2, 4, 5, 10, 12; XVII. 1, 5, 9; XXII. 9, 16; XXX. 9. **Shropshire**, XLIX. 13, 14, 16; LVI. 2, 6, 8, 9, 12, 15, 16; LVII. 9; LVIII. 15; LXII. 13, 14; LXIII. 16; LXIV. 1, 6, 8, 10, 12, 13, 15, 16; LXV. 1, 9, 11, 13, 14, 15, 16; LXVI. 1, 2, 3, 4, 6, 7, 8, 10, 11, 13, 14, 16; LXVII. 1, 5, 9, 13, 14, 15; LXVIII. 4, 7; LXIX. 5, 6, 8, 10, 15; LXX. 1, 4, 8, 9, 12; LXXI. 2, 3, 5, 6, 7, 9, 10, 11, 12; LXXII. 2; LXXVI 1. **Somerset**, V. 12, 15, 16; VII. 11; VIII. 14; XI. 3, 4; LXXXVII. 3, 5. **Staffordshire**, LV. 12; LVI. 1, 2, 4; LXIV. 8, 9, 10; LXVII. 3, 7, 11, 14; LXX. 4, 8, 12. **Warwickshire**, IV. 7, 8, 9, 10; VI. 13. **Worcestershire (and Do. Det.** No. 1), I. 11; VIII. 5; XXI. 1, 12; XXII. 1, 10; LIX. 3, 4, 7; LX. 3. **Yorkshire**, CCLXXXIII 16; CCLXXXIV. 5; CCLXXXV. 4; CCLXXXVI. 6. 3s. *each*.

(*E. Stanford, London Agent.*)

Germany. **Symper.**

Karte des Vorkehrs auf Deutschen Wasserstrassen im Jahre 1900 Nach den Ergebnissen der Statistik des Deutschen Reiches nach Handelskammerberichten und anderweiten Quellen auf Anordnung des Herrn Ministers der öffentlichen Arbeiten zusammengestelt von Symper, Geheimer Baurat. Scale 1 : 1,250,000 or 19 7 stat. miles to an inch. 4 sheets. Berlin : Verlag des Berliner Lith. Instituts. *Price 6m.*

By means of carefully selected symbols and colours, a great deal of most useful information is given on this map concerning German commerce, and exports and imports passing through Germany by means of the waterways. Coloured bands follow the principal rivers and canals, varying in breadth according to the commercial importance and extent of trade. The relative amount of exports and imports of the principal towns near the rivers is indicated by the character in which the town is shown, and information is given concerning the navigability of the rivers and other kindred subjects, both on the map itself and in the accompanying letterpress. In many respects this map resembles that published by the same department in 1887, of which it may, in fact, be considered a new edition.

London. **Bartholomew.**

The Pocket Atlas and Guide to London. By J. G. Bartholomew, F.R.G.S. Enlarged edition. London: John Walker & Co., 1903 *Presented by the Publishers.*

A new edition of a useful little pocket atlas of London, revised and enlarged. To save space, the index to streets, etc., is printed upon the back of the maps.

Portugal. **Portuguese Government.**

Portugal. Scale 1:100,000 or 1·5 stat. miles to an inch. Sheets 9 and 13. Levantada, construida e gravada pela Direcção geral dos trabalhos geodesicos e topographicos. Publicada em 1898, 1900.

Sweden. **Rikets Allmänna Kartverk.**

General Karta öfver Sverige. Scale 1:1,000,000 or 15 7 stat. miles to an inch. Sheet 1; scale 1:200,000 or 3·1 stat. miles to an inch. Sheets: 47, Risbäck; 49,

Lycksele; 50, Norsjö; 73, Bräcke; 79, Sundsvall; 84, Hudiksvall.—Scale 1 : 100,000 or 1·5 stat. mile to an inch. Sheet 105, Ockelbo. Stockholm: Rikets Allmänna Kartverk. *Presented by the Swedish Government Survey.*

Vienna. **Artaria.**

Plan der K.K. Reichshaupt und Residenzstadt Wien. Ausgabe, 1903. Bearbeitet im Geographischen Institute (Dr. Karl Peucker) der Verlagshandlung Artaria & Co. in Wien. Scale 1 : 25,000 or 586·4 yards to an inch. Vienna: Artaria & Co., 1903. *Presented by the Publisher.*

ASIA.

Philippine Islands. **Military Information Division, War Department, Washington.**

Map of Mindanao, Philippine Islands. Scale 1 : 792,000 or 12·5 stat. miles to an inch. Prepared in the War Department, Adjutant-General's Office, Military Information Division, Washington, 1902.

This is a preliminary map, and shows no hill-work. Outline and lettering are in black and sea blue.

AFRICA.

Africa. **Intelligence Division, War Office.**

Africa. Scale 1 : 1,000,000 or 15·7 stat. miles to an inch. Sheets: 50, Sokoto, 51, Kano; 52, Lake Chad. London: Intelligence Division, War Office, 1903. Stanford. *Price 2s. each sheet. Presented by the Director-General of Mobilization and Military Intelligence.*

Algeria. **Ministère des Travaux Publics.**

Carte Géologique de l'Algérie. Troisième édition, rectifiée et complètée par le Service de la Carte Géologique de l'Algérie. Ministère des Travaux Publics. Gouvernement Général de l'Algérie. Paris: Ch. Béranger, 1900.

A comparison of this edition with that published in 1892 shows that considerable advance has been made in the knowledge of the geological formation of the country since that date. Information of a detailed character takes the place of generalizations and regions that were ten years ago unexplored geologically have now been surveyed. The map is well executed, and the registration of the colours very good.

Algeria. **Service Géographique de l'Armée, Paris.**

Carte de l'Algérie. Scale 1 : 50,000 or 0·78 stat. mile to an inch. Sheet No. 120, Aïne Mlila. Paris: Service Géographique de l'Armée. *Price* 15.0 *fr.*

Central Africa. **Marchand.**

Mission Marchand. Haut Oubangui- Bahrel-Ghazel- Nil- Ethiopie- Djibouti. Carte publiée sous les auspices de la Société de Géographie de Paris. Dressée et dessinée par le Commandant Baratier d'après les travaux topographiques et astronomiques de les Mission Marchand et d'après les itinéraires des Officiers du Haut Oubangui, de M. Faivre (Expedition du Dedjaz Thessama), de la Mission de Bonchamp, de la Mission Bòttego, et des anciens voyageurs. Scale 1 : 1,000,000 or 15·7 stat. miles to an inch. 4 sheets. Paris: H. Barrère, 1903. *Presented by the Publisher.*

This map will be specially noticed in the *Geographical Journal.*

Tunis. **Service Géographique de l'Armée, Paris.**

Tunisie. Scale 1 : 50,000 or 0·78 stat. mile to an inch. Sheet No. xxxviii., Ouargha. Paris: Service Géographique de l'Armée. *Price* 1.50 *fr.*

AMERICA.

Canada. **Surveyor-General's Office, Ottawa.**

Sectional Map of Canada. Scale 1 : 190,080 or 3 stat. miles to an inch. Moosejaw Sheet (42), West of Second Meridian, revised to January 12, 1903; Touchwood Sheet (44), West of Second Meridian, revised to March 2, 1903; Saskatoon Sheet (53), West of Third Meridian, revised to October 22, 1902; Pincer Creek Sheet (81), West of Fifth Meridian, revised to March 9, 1903; Porcupine Sheet (82), West of Fifth Meridian, revised to February 20, 1903. Ottawa: Surveyor-General's Office. *Presented by the Surveyor-General of Canada.*

Peru. **Cisneros.**

Atlas del Perú, Politico, Minero, Agricola, Industrial y Commercial (con las

ultimas demarcaciones territoriales) y Texto descriptivo de cada departamento. Por Carolos B. Cisneros. Lima: Libreria é Imprenta Gil. *Presented by the Author.*

This atlas of Peru will be specially noticed in the *Geographical Journal.*

United States. **Rand, McNally & Co.**

Indexed County and Township Pocket Maps.—New Jersey. Scale 1 : 570,240 or 9 stat. miles to an inch. New Mexico Scale 1 : 1,900,800 or 30 stat. miles to an inch. New York. Scale 1 : 570,240 or 9 stat. miles to an inch. Chicago and New York: Rand, McNally & Co. *Price* $0.25 *each. Presented by the Publishers.*

These are new editions.

GENERAL.

French Colonies. **Pelet.**

Atlas des Colonies Françaises. Dressé par ordre du Ministère des Colonies par Paul Pelet. Livraison 9. Paris: Armand Colin et Cie. *Price* 3 *fr.*

Part No. 9 contains map No. 1, a general map of the world on an elliptical projection, showing the French colonies, transcontinental and other important railways, principal telegraph lines, and steamship routes. No. 2, a map of Northern and Central Africa, showing the French possessions; and No. 27, a sheet containing nine plans of French colonial naval depôts. In addition to these, there are ten pages of descriptive letterpress, as well as the title-page, list of contents and alphabetical index to the whole atlas. Although this part has but just appeared, the maps are dated January and July, 1901, and are consequently already out of date in several respects.

This atlas is now complete, and comprises altogether twenty-seven sheets of maps, besides numerous insets. Each map is accompanied by several pages of descriptive and statistical letterpress, and altogether it is a very creditable production. The maps are printed in colours, and the routes of important French explorers are shown in red. The price of the complete atlas bound in cloth is 30 francs.

World. **Schrader.**

L'Année Cartographique. Supplément annuel a toutes les publications de Géographie et de Cartographie. Dressé et rédigé sous la direction de F. Schrader. Douzième supplément contenant les modifications géographiques et politiques des années 1900–1901. Paris: Hachette et Cie., 1903. *Price* 3 *fr.*

A separate notice of this appears on p. 666.

CHARTS.

North Atlantic Ocean and Mediterranean Sea. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for May, 1903. London: Meteorological Office. *Price* 6*d. Presented by the Meteorological Office, London.*

United States Chart. **United States Hydrographic Office.**

Pilot Charts of the North Atlantic Ocean for April, and of the North Pacific Ocean for May, 1903. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Colombia. **Crease.**

Seven photographs of lakes of the Central Cordillera of the Andes of Colombia, taken by Herbert H. Crease, Esq. *Presented by Herbert H. Crease, Esq.*

An excellent set of platinotypes, measuring 8¼ × 6¼ inches.

(1 and 2) Lake Fuguene; (3) Lake Suesca; (4) Lake Siecha (part drained for treasure); (5) Lake Siecha (part undrained); (6) Lake Guatavita (showing Spanish cutting); (7) Lake Guatavita (taken from entrance to Spanish cutting).

Ecuador. **Rice.**

Thirty-two photographs taken on a voyage from Quito to the Amazon *viâ* the river Napo. By A. Hamilton Rice, Esq. *Presented by A. Hamilton Rice, Esq.*

These form an interesting addition to the Society's collection. The platinotypes, of which there are five, are specially clear. They are as follows:—

(1) The cathedral, Quito; (2 and 3) The Napo river at Negro Hurco, below the Curaray river; (4) Indian women, Curaray; (5) House of the Letter type, mouth of the Curaray river; (6 and 7) Camp on the Napo river, above the Curaray river; (8) The landing-place of a Napo village; (9) Trader and Indian family ascending the Napo river; (10) Peons resting at the Maspa river; (11) Camp in the eastern range of the Andes, upon the flood floor of the Cosanga river; (12) Indian village, mouth of the

Curaray river; (13) President's palace, and square where Garcia Moreno was cut to pieces; (14) Cantaliver bridge over the Maspa river, Eastern Andes; (15) Indians of Señor Atto, a Portuguese Peruvian cauchero of the Curaray, landing for a meal on one of the sandbars of the Napo; (16) Felipe Salagage, chief peon of Papallactan Indians; (17) Hacienda Itulcachi; (18) Under Chimborazo; (19) Chimborazo from the east; (20) Tambo Chuquipoquio; (21) Iquitos Peru, on the Amazon; (22) Type of South American canoe; (23) Archidona, capital of the Oriente; (24) Government House at Archidona; (25) Government officials and traders, Archidona; (26) Sunday morning in Archidona, rounding up the Indians; (27 and 28) Napo Indians, Archidona; (29) Napo village, six hours from Archidona.

Persia. **Penton.**

Ninety-five photographs of Persia, taken by E. Penton, Esq. *Presented by E. Penton, Esq.*

Mr. Penton described his route through Persia from India *viâ* Seistan in the *Geographical Journal* for July, 1902. It was during this journey that these photographs were taken. The following is a list of the titles:—

(1–9) Birjand; (10) Pond at Birjand; (11) Summer house, Birjand (12–14) Nushki; (15) Group at Nushki; (16) Interior of Nasratabad; (17) British Consulate at Nasratabad; (18) Servant at the Consulate; (19) Mohammed Ali Bros, Nasratabad, (20 and 21) Saindak; (22) Seistani camel-driver; (23 and 24) Mansur Khan; (25) Asadabad; (26) A morning halt; (27) Kundi; (28) A Persian Shiah; (29) Mushki-Chah; (30) Baua pass; (31) Tahib Chah; (32) Chah Mohammed Raza; (33 and 34) Groups of Beluchis; (35) A young Beluchi; (36) A well; (37) Camel-drivers eating; (38) Two men of Mr. Penton's escort; (39) Mr. Penton's servant and camel; (40) A halt; (41) Dalbandin; (42) At Dalbandin; (43) Padag; (44) Merui; (45) Orchard at Dehak; (46) Hazara; (47) Dasht-i-Piaz; (48) Camel owner and camels; (49) Shusp; (50) Dak bungalow; (51) Girdi-Talab; (52) Benu and his escort; (53) Bandan; (54) Persian Beluchis; (55) Seith Suliman; (56) Novad Chah; (57–59) Halting caravan; (60) Caravan in motion; (61) Caravanserai; (62) Push-ti-Dasht, (63) Kishingi; (64) Salabad; (65 and 66) Idoo the Pahlwan; (67 and 68) Robat; (69) Robat Dak bungalow; (70) Meshed; (71) Main Street, Meshed; (72) Bidar pass; (73) Crops at Amroni; (74) A Persian village; (75) A thana; (76 and 77) Interior of a Persian thana; (78–80) Chanhuk; (81 and 82) Mall; (83) New bungalow at Mall; (84) Thanadar at Mall. (85–89) Typical Baluchistan scenery; (90 and 91) A sandstorm; (92) A thanadar; (93 and 94) Crossing the Helmand lagoon; (95) Trato.

South Australia. **Maurice.**

Sixty-two photographs of South and Western Australia, taken by R. T. Maurice, Esq., 1901–1902. *Presented by R. T. Maurice, Esq.*

The expeditions upon which these photographs were taken extended from Ooldea well to the Rawlinson ranges, and from Fowler's bay to Cambridge gulf. Copies of some of the photographs have already been presented to the Society, and were noticed in the *Geographical Journal* for Dec. 1902. This album, however, contains some important additions, principally views of scenery.

(1) Mr. W. Murray and Mr. R. T. Maurice, with natives; (2 and 3) Showing measurements of natives; (4) Backs of natives, showing tribe marks; (5) Everard range black, "Napparinya Kallatinya," throwing boomerang; (6) "Napparinya Kallatinya," attitude of rest; (7) "Munjena," Waldoona black, throwing spear; (8) Fighting with boomerangs; (9) Ready to fight; (10) Painted for Corroborree; (11, 13, 14, 16, 17, 20, 25, 47) Parrina, native dam; (12, 18, 21, 22, 38, 41, 51, 52, 55–61) Glen Cumming; (15) Permanent water, Wilhanya; (19 and 39) Jamison range; (23 and 24) Portion of Jamison range; (26 and 49) Point on the Elder expedition; (27) Waldoona native women; (28) Bush to purify water in Rockhole; (29) Lubra; (30) Range between Rawlinson and Cavenough; (31) Murdered white man; (32 and 33) Sandhills, Jamison range; (34, 42, 43, and 50) Rawlinson range; (35) Permanent Koonunda water well; (37, 40, 48) Sladen water, Rawlinson range; (44) Mann range; (45) Gosse's pile (marked tree); (46) Koonundoo, native women; (53 and 54) Tree, Rawlinson range, marked by a member of the expedition led by Merton; (62) Native.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

INDEX.

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EUROPE.

* The map is not yet ready, but will probably be issued with the August number. It may then either be inserted in its place in the present volume or be bound up with volume xxii.

ASIA.

AFRICA.

AMERICA.

GENERAL.

PRINTED BY WILLIAM CLOWES AND SONS, LIMITED, LONDON AND BECCLES.